UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

Date: June 7, 2003

MEMORANDUM

SUBJECT: REVISED OCCUPATIONAL AND RESIDENTIAL EXPOSURE ASSESSMENT AND RECOMMENDATIONS FOR THE REREGISTRATION ELIGIBILITY DECISION DOCUMENT FOR OXADIAZON

FROM: Seyed Tadayon, Chemist
Reregistration Branch III
Health Effect Division (7509C)

THRU: Cathy Eiden, Senior Scientist
Reregistration Branch III
Health Effects Division (7509C)

TO: Nancy McCarroll, Geneticist
Toxicology Branch I
Health Effects Division (7509C)

Please find the review of oxadiazon.

DP Barcode: D290006

PC Codes: 109001

EPA Reg Nos: 264-450, 264-502, 432-886, 432-887, 432-893, 432-898, 538-143, 538-146, 538-147, 538-164, 538-241, 538-257, 961-340, 961-371, 961-379, 961-380, 961-382, 8660-17, 8660-35, 8660-36, 9198-75, 9198-154, 9198-155, 10404-63, 10404-93, 34704-771, 35512-43, 35512-44, 48234-1, 48234-2, 48234-10, 48234-14, 48234-15, 52287-1, 52287-2, 52287-3, 55615-4, 55615-5, 67508-1, CA97001800, FL82004500, HI97000100.

EPA MRID No: 449955-01, 449955-02, 435178-01

LUIS Report: 05/04/99

PHED: Yes, Version 1.1

CONTENTS

EXECUTIVE SUMMARY

Purpose

This is a revision of the original *Occupational and Residential Exposure Assessment and Recommendations Document for Oxadiazon*, (S. Tadayon July 15, 2001). This chapter has been revised to address comments made by Bayer Crop Science.

This document addresses the exposures and risks associated with the use of the oxadiazon, that occur through non-dietary exposure. These exposures can occur as a result of applying oxadiazon or by entering areas that have been previously treated with oxadiazon. Exposures can occur as a part of one's job or through uses of oxadiazon on residential lawns and other areas that are frequented by the general public. Occupational and residential exposures are addressed separately in this document.

Oxadiazon, 2-tert-butyl-4- (2,4-dichloro-5-isopropoxyphenyl-1,3,4-oxadiazolin-5-one), is a selective pre emergence and early post emergence herbicide used primarily to control annual grasses and broadleaf weeds. The occupational use sites include golf course turf, ornamental turf, conifer nursery, landscape - industrial sites, ornamental noncroplands, roadside landscape plantings, sod farms, woody ornamental shrubs, vines and trees and herbaceous ornamental crops. The outdoor residential use site include cemeteries, athletic fields, residential condominiums and school ground. A wide variety of application techniques have been identified that could potentially be used to apply oxadiazon such as groundboom sprayers, handheld sprayers (low and high pressure devices and low pressure/high volume sprayguns commonly used on turf), backpack sprayers, tractor-drawn granular spreaders, push-type granular lawn spreaders, and bellygrinders. Oxadiazon is formulated as a manufacturing product (94.0% active ingredient), several granular formulations (up to 50.0% active ingredient) and three wettable powders (50.0% active ingredient).

Hazard Identification

The Report of the Hazard Identification Assessment Review Committee (HIARC) for oxadiazon, dated December 21, 2000, indicates that there are toxicological endpoints of concern for oxadiazon. A short-term (1-7 days) to intermediate-term (one week to several months) oral endpoint was selected for incidental oral exposure in children, using a NOAEL of 12 mg/kg/day based on a statistically significant decrease in maternal body weight gains at 40 mg/kg/day (LOAEL) in a developmental study in rats.

For short-term and intermediate dermal exposure, an oral endpoint was selected using a NOAEL of 12 mg/kg/day based on a statistically significant decrease in maternal body weight gains at 40 mg/kg/day (LOAEL) in a developmental study in rats. The committee recommended a dermal absorption factor of 9% (rounded up from 8.7%) based on a dermal penetration study to be used in the calculation.

Due to a lack of inhalation studies, the HIARC selected an endpoint from oral studies for inhalation risk assessments. For short and intermediate-term inhalation exposure, the same oral study was chosen as for dermal exposure of this duration, with a NOAEL of 12 mg/kg/day. An absorption factor of 100% is applied for inhalation exposures. The target margin of exposure (MOE) of 100 or more for occupational exposure scenarios was selected based upon 10x for intraspecies and 10x for interspecies variation. Because the effects from dermal and inhalation exposure are the same, the doses for these routes and duration may be aggregated.

Since 1987, the Agency's decision on the carcinogenic potential of oxadiazon concurred with the Scientific Advisory Panel's (SAP) classification of oxadiazon as a Group C carcinogen and the Q_1* had been set at 1.4×10^{-1}(mg/kg/day)$^{-1}$ in human equivalents**.** Since that time, new chronic/carcinogenicity data have been submitted and reviewed by the Cancer Assessment Review Committee (CARC). Based on this revisit, CARC has reclassified oxadizon as a **"Likely To Be Carcinogenic To Humans"**. For the purpose of the lifetime cancer risk assessment by the Agency, the most potent unit risk, Q_1^*, is that for male mouse liver adenoma and/or carcinoma combined tumor rates at **7.11×10^{-2}** (mg/kg/day)$^{-1}$ in human equivalents. All unit risks have been converted from animals to humans by use of the $^3/_4$'s scaling factor.

Oxadiazon **has not** been reported to cause life-threatening illness or death. Most of the cases appear to be related to irritation to the skin, eyes and mucous membranes. Some cases may be related to an allergic reaction On the list of the top 200 chemicals for which NPTN (National Pesticide Telecommunications Network) received calls from 1984-1991 inclusively, oxadiazon was ranked 192nd with 12 incidents in humans reported and 5 incidents in animals (mostly pets).

Occupational Handler Exposure and Risk Estimates

HED has determined that there are potential exposures to mixers, loaders, applicators, and other handlers during usual use-patterns associated with oxadiazon. Fourteen major exposure scenarios were identified for oxadiazon, including mixing, loading, and applying using ground spray, granular, and lawn application methods.

Handler Scenarios with Risk Concerns

The results of the **short and intermediate-term handler** assessments indicate that all potential exposure scenarios provide at least one application rate with a total MOE(s) greater than or equal to 100 at either the **baseline** (i.e., long pants, long sleeved shirts, no gloves) using open systems**, PPE** (i.e., long pants, long sleeved shirts, and chemical resistant gloves while using open systems) or using **engineering controls** (i.e., closed systems). In the majority of cases, it is dermal exposure rather than the inhalation exposure driving the total MOEs. In total, 37 MOEs were calculated for the various application rates. The total MOEs for all the scenarios range from 2 to 3000.

The results of the **Cancer** Risk indicate that the values range from 1.65E-2 to 4.66E-7 at

the baseline (i.e.long pants, long shirts and no gloves), 2.56E-3 to 4.11E-7 at PPE1 (i.e.long pants, long shirts, gloves and no respirator), 2.40E-3 to3.51E-7 at PPE2 (i.e. long pants, long shirts, double layer, gloves and no respirator), 1.05E-3 to 1.98E-7 at PPE3 (i.e. long pants, long shirts, gloves and respirator), 8.90E-4 to 1.38E-07 at PPE4 (i.e. long pants, long shirts, double layer, gloves and respirator) and 4.92E-5 to 1.10E-8 at engineering control.

Postapplication Worker Exposure and Risk Estimates

Most of the oxadiazon used on golf course turf (77%), ornamental turf, conifer nursery, landscape - industrial sites, ornamental non-croplands, roadside landscape planting, sod farms, woody ornamental shrubs, vines and trees and herbaceous ornamental crops is applied early in the season, either pre-plant or before weeds emerge (pre-emergence). This fact, and the degree of mechanization in cultivating these crops, minimizes the postapplication contact of workers with the chemical on these crops. Three chemical-specific studies, were submitted to the Agency for consideration. Theses studies were reviewed and only the re-entry study found to be acceptable for use in the oxadiazon risk assessment.

Using the revised residential SOP postapplication short- and intermediate-term dermal risk estimates for occupational workers are between 30 and 1,000. The cancer risk for all occupational handlers is between 9.92×10^{-5} to 3.01×10^{-6}.

Residential Postapplication Exposure and Risk Estimates

Dermal postapplication exposure estimates were conducted using the highest mean postapplication residue from the Jazzercise study (wettable powder formulations). The dermal transfer coefficients from the Jazzercize study and the revised residential SOPs were used. Using the Jazzercize wettable powder application study residue data and revised residential SOPs , all of the scenario had short-term and intermediate dermal MOEs greater than 100. The cancer risks for all residential dermal postapplication is between 6.22×10^{-6} to 7.51×10^{-7}.

The Residential SOPs and submitted Jazzercize study data were used to estimate incidental oral exposure for toddlers on treated turf. The short-term MOE was100 for the toddler hand-to-mouth using residential SOPs and between 90 to 240 for the submitted study. The intermediate-term MOE was not calculated since exposure by this route for weeks to months is considered less likely to occur than short-term exposure. Incidental turfgrass mouthing and soil ingestion had MOEs greater than 100 for short-term exposures.

Uncertainties in Risk Assessment and Data Gaps

Residential handler exposure and risk estimates were conducted using a set of surrogate chemical data: the ORETF study data and the Residential SOPs. Dermal postapplication exposures to oxadiazon were based on the highest residues from the chemical-specific re-entry study data and are of fairly high confidence. Oral ingestion scenarios are based on standard

assumptions and formulae (Residential SOPs) which are designed to be screening level. Granular ingestion is considered episodic in nature.

1.0 BACKGROUND

Purpose

In this document, which is for use in EPA's development of the oxadizon. Reregistration Eligibility Decision Document (RED), EPA presents the results of its review of the potential human health effects of occupational and residential exposure to oxadiazon.

Criteria for Conducting Exposure Assessments

An occupational and/or residential exposure assessment is required for an active ingredient if (1) certain toxicological criteria are triggered and (2) there is potential exposure to handlers (mixers, loaders, applicators, etc.) during use or to persons entering treated sites after application is complete. For oxadiazon, both criteria are met.

1.1 Summary of Toxicity Concerns Relating to Agricultural Exposures

Acute Toxicology Categories

Table 1 presents the acute toxicity categories as outlined in the Hazard Identification Document (Dec 21, 2000).[1]

Table 1: Acute Toxicity Categories For Oxadiazon

Guideline No.	Study Type	MRID #(S).	Results	Toxicity Category
81-1	Acute Oral-Rat	41866501	LD_{50} = > 5000 mg/kg (♂♀, combined)	IV
81-2	Acute Dermal-Rabbit	41866502	LD_{50} = > 2000 mg/kg (♂♀, combined)	III
81-3	Acute Inhalation-Rat	41866503	LC_{50} = > 1.94 mg/L (♂♀, combined)	III
81-4	Primary Eye Irritation- Rabbit	41866504	Mild irritant to ocular tissue	III
81-5	Primary Skin Irritation- Rabbit	41866505	Negligibly irritating to skin	III
81-6	Dermal Sensitization- Guinea Pig	41230401	Not a dermal sensitizer (Buehler test)	--
81-8	Acute Neurotoxicity	ND		

Other Endpoints of Concern

The report of the Hazard Identification Assessment Review Committee (HIARC) for

oxadiazon, dated Dec 21, 2000[1], identified toxicological endpoints of concern for oxadiazon.

All calculations completed in this document are based on the most current toxicity information available for oxadiazon. The endpoints that were used to complete this assessment are summarized below in Table 2:

Table 2: Endpoints selected by HIARC for Assessing Occupational and Residential Risks for Oxadiazon

EXPOSURE SCENARIO	DOSE (mg/kg/day)	ENDPOINT	STUDY
Incidental Oral, Short-Term	NOAEL= 12 Maternal effects	Reduced body weight/body weight gain at 40 mg/kg/day (LOAEL).	Developmental Toxicity -Rat MRID No. 40470202
Incidental Oral, Intermediate-Term	NOAEL= 12 Maternal effects	Reduced body weight/body weight gain at 40 mg/kg/day (LOAEL).	Developmental Toxicity -Rat MRID No. 40470202
Dermal, Short-Term	NOAEL= 12 Maternal effects/ Developmental effects	Reduced body weight/body weight gain at 40 mg/kg/day (LOAEL) / Increased fetal resorptions/postimplantation loss, increased incidence of incomplete ossification at 40 mg/kg/day (LOAEL). **For this risk assessment, the dermal absorption rate of 9% is applied.**	Developmental Toxicity -Rat MRID No. 40470202
Dermal, Intermediate-Term	NOAEL= 12 Maternal effects/ Developmental effects	Reduced body weight/body weight gain at 40 mg/kg/day (LOAEL) / Increased fetal resorptions/postimplantation loss, increased incidence of incomplete ossification at 40 mg/kg/day (LOAEL). **For this risk assessment, the dermal absorption rate of 9% is applied**.	Developmental Toxicity - Rat MRID No. 40470202
Dermal, Long-Term	NOAEL=0.36	Reduced body weight/body weight gain at 40 mg/kg/day (LOAEL) / Increased centrilobular swelling in male livers at 3.5 mg/kg/day (LOAEL). **For this risk assessment**, **the dermal absorption rate of 9% is applied.**	Combined Chronic Feeding/ Oncogenicity - Rat MRID Nos. 40993401, 00149003/00157780
Inhalation, Short-Term	NOAEL= 12 Maternal effects/ Developmental effects	Reduced body weight/body weight gain at 40 mg/kg/day (LOAEL) / Increased fetal resorptions/postimplantation loss, increased incidence of incomplete ossification at 40 mg/kg/day (LOAEL). **For this risk assessment, route-to-route extrapolation and a 100% absorption rate are applied**	Developmental Toxicity - Rat MRID No. 40470202
Inhalation, Intermediate-Term	NOAEL= 12 Maternal effects/ Developmental effects	Reduced body weight/body weight gain at 40 mg/kg/day (LOAEL) / Increased fetal resorptions/postimplantation loss, increased incidence of incomplete ossification at 40 mg/kg/day (LOAEL). **For this risk assessment, route-to-route extrapolation and a 100% absorption rate are applied.**	Developmental Toxicity - Rat MRID No. 40470202
Inhalation, Long-Term	NOAEL= 0.36	Increased centrilobular swelling in male livers at 3.5 mg/kg/day (LOAEL). **Route-to-route extrapolation and a 100% absorption rate aplied.**	Combined Chronic Feeding/ Oncogenicity - Rat MRID Nos. 40993401, 00149003/00157780
Cancer	Q_1* of 7.11 x 10^{-2} $(mg/kg/day)^{-1}$	Significant increase (pair-wise and trend, $p<0.01$) in liver adenomas and adenomas and/or carcinomas combined in males at $\geq$9.3 mg/kg/day).	Combined Chronic Feeding/ Carcinogenicity - Mouse MRID Nos. 40993301

1.2 Summary of Use Patterns and Formulations

At this time, products containing oxadiazon are intended for both occupational and

residential uses.

Type of pesticide/target pests

Oxadiazon, 2-tert-butyl-4- (2,4-dichloro-5-isopropoxyphenyl-1,3,4-oxadiazolin-5-one), is a selective pre-emergence and early post emergence herbicide used primarily to control annual grasses and broadleaf weeds. Table 3 presents a list of oxadiazons 's active products. The annual grasses and broadleaves controlled by oxadiazon include the following:

1. **Annual grasses:** annual blugrass, barnyardgrass, crabgrass, fall panicum, giant foxtail (yellow and green), goosegrass, junglerice, signalgrass, sprangletop, Texas panicum and hophornbeam copperleaf
- **Broadleaves:** Florida beggarweed, carpet weed, cudweed, dayflower, ducksalad, filaree, groundsel, jimsonweed, lambersquarters, mustards, pigweed, prickly sida, prostrate knotweed, purslane, purslane, redmaids, smartweed, sowthistle, velvetleaf, morningglory and black night shade

Formulation types and percent active ingredient

Oxadiazon is formulated as a manufacturing product (94.0% active ingredient), several granular formulations (up to 50.0% active ingredient) and three wettable powders (50.0% active ingredient). Wettable powders are marketed in bags and water soluble bags.

Registered use sites, application rates and frequency of application

Oxadiazon is applied as a pre-plant or pre-emergent herbicide on non-food/outdoor crops. occupational applications (i.e., to turf and ornamentals) are made to established areas such as lawns or golf course greens prior to the emergence of the target plant species. Residential/ non-occupational applications are made to residential lawns, parks, cemeteries, schools, athletic fields and golf courses. The frequency of application ranges from 1 to 3 applications per season. Oxadiazon can be applied at a minimum application rate of 2.0 pounds of active ingredient per acre up to a maximum application rate of 4.0 pounds active ingredient per acre to turf and ornamentals. Oxadiazon use sites are non-food crops (primarily golf course greens, 77% of all use), residential outdoor use (approximately 12% of all use), roadside (approximately 3% of all use) and nurseries (approximately 8% of all use). The granular formulations account for 91% of the total oxadiazon use (turf use).

Table 3 represents information on registered use sites, products name, application rates, percent active ingredient and frequency of application per growing season for oxadiazon[2]. Application rate covers various type of equipment used to apply oxadiazon.

Table 3: Use Patterns, Application Rate, and Frequency of Application for Oxadiazon					
Reg No	A.I %	Product Name	Crop Type	Max Appl rate	No of Appl per/y
10404-63	0.95	Lesco Turfic for Crabgrass with Ronstar G	turf: golf course	4 lb ai/acre	3
10404-63	0.95	Lesco Turfic for Crabgrass with RonstarG	turf: ornamental	4 lb ai/acre	3
10404-93	0.63	Ronstar Weed and Feed 63 G	nursery: woody ornamental shrubs, vines and trees	4 lb ai/acre	3
10404-93	0.63	Ronstar Weed and Feed 63 G	nursery: woody ornamental shrubs, vines and trees	4 lb ai/acre	3
10404-93	0.63	Ronstar Weed and Feed 63 G	turf: golf course	4 lb ai/acre	3
10404-93	0.63	Ronstar Weed and Feed 63 G	turf: ornamental (parks, athletic fields, recreational)	4 lb ai/acre	3
10404-93	0.63	Ronstar Weed and Feed 63 G	turf: sod farms	4 lb ai/acre	3
264-445	2	Chipco Ronstar G	nursery: conifer	4 lb ai/acre	1
264-445	2	Chipco Ronstar G	nursery: woody ornamentals, shrubs, vines and trees	4 lb ai/acre	1
264-445	2	Chipco Ronstar G	turf: golf course	4 lb ai/acre	1
264-445	2	Chipco Ronstar G	turf: lawns	4 lb ai/acre	1
264-445	2	Chipco Ronstar G	turf: ornamental (parks)	4 lb ai/acre	1
264-450	94	oxadiazon technical	Formulating use only		
264-502	50	Ronstar 50% Intermediate	Formulating use only		
264-538	50	Chipco Ronstar 50 WSP	landscape: woody ornamental shrubs, vines and trees	2 lb ai/acre	1
264-538	50	Chipco Ronstar 50 WSP	nursery: conifer	4 lb ai/acre	1
264-538	50	Chipco Ronstar 50 WSP	nursery: woody ornamental shrubs, vines and trees	4 lb ai/acre	1
264-538	50	Chipco Ronstar 50 WSP	turf: golf course (no tees and greens)	3 lb ai/acre	3
264-538	50	Chipco Ronstar 50 WSP	turf: ornamental (parks)	3 lb ai/acre	3
264-538	50	Chipco Ronstar 50 WSP	turf: sod farms in HI	3 lb ai/acre	3
34704-771	2	Napropamide-Oxadiazon 4-2 Granules	landscape: woody ornamental shurbs vines and trees	3 lb ai/acre	
34704-771	2	Napropamide-Oxadiazon 4-2 Granules	nursery: conifer	3 lb ai/acre	
34704-771	2	Napropamide-Oxadiazon 4-2 Granules	nursery: woody ornamental shurbs vines and trees	3 lb ai/acre	
35512-43	1	Turf Pride Fertilizer with Ronstar 5-20G	turf: golf course	4 lb ai/acre	1
35512-43	1	Turf Pride Fertilizer with Ronstar 5-20G	turf: ornamental (parks, athletic fields, recreational)	4 lb ai/acre	1
35512-43	1	Turf Pride Fertilizer with Ronstar 5-20G	turf: sod farms	4 lb ai/acre	1
35512-44	1	RegalstarG	turf: established	2 lb ai/acre	1
35512-44	1	RegalstarG	turf: golf course	2 lb ai/acre	1
48234-1	1	RegalstarG	turf: established	2 lb ai/acre	1
48234-1	1	RegalstarG	turf: golf course (not greens)	2 lb ai/acre	1
48234-10	1	Regal-O-Herbicide G	landscape: woody ornamental shrubs, vines and trees	3 lb ai/acre	
48234-10	1	Regal-O-Herbicide G	nursery: woody ornamentals shrubs, trees, vines	3 lb ai/acre	
48234-10	1	Regal Ronstar Plus I G	nursery: woody ornamentals shrubs, trees, vines	4 lb ai/acre	3
48234-10	1	Regal Ronstar Plus I G	turf: golf course	4 lb ai/acre	1
48234-10	1	Regal Ronstar Plus I G	turf: ornamental	4 lb ai/acre	1
48234-15	1	RegalStar II G	landscape: woody ornamentals shrubs, trees, vines	2 lb ai/acre	1
48234-15	1	RegalStar II G	nursery: woody ornamentals shrubs, trees, vines	2 lb ai/acre	1
48234-15	1	RegalStar II G	turf: golf course	2 lb ai/acre	1
48234-15	1	RegalStar II G	turf: sod farms	2 lb ai/acre	1
48234-2	2	Regal Ronstar Plus G	landscape: woody ornamental shrubs, vines and trees	4 lb ai/acre	1
48234-2	2	Regal Ronstar Plus G	nursery: conifer	4 lb ai/acre	1
48234-2	2	Regal Ronstar Plus G	nursery: woody ornamental shrubs, vines and trees	4 lb ai/acre	3
48234-2	2	Regal Ronstar Plus G	turf: golf course	4 lb ai/acre	1
48234-2	2	Regal Ronstar Plus G	turf: ornamental (parks)	4 lb ai/acre	1
52287-1	0.95	Harrells Crabgrass Control with Ronstar G	turf: golf course	4 lb ai/acre	3
52287-1	0.95	Harrells Crabgrass Control with Ronstar G	turf: ornamental	4 lb ai/acre	3
52287-2	1.5	Harrells Ronstar 1.5 G	turf: golf course	4 lb ai/acre	3
52287-2	1.5	Harrells Ronstar 1.5 G	turf: ornamental	4 lb ai/acre	3
52287-3	0.67	Harrells Ronstar 0.67 with Fertilizer G	turf: golf course	4 lb ai/acre	3
52287-3	0.67	Harrells Ronstar 0.67 with FertilizerG	turf: ornamental	4 lb ai/acre	3
538-164	1.31	Scotts ProTurf Goosegrass/Crabgrass Control 8656	turf: golf course (fairways and greens)	0.75	
538-164	1.31	Scotts ProTurf Goosegrass/Crabgrass Control 8656	turf: golf course (fairways and tees)	1.5	
538-164	1.31	Scotts ProTurf Goosegrass/Crabgrass Control 8656G	turf: golf course (greens)	1.5	
538-164	1.31	Scotts ProTurf Goosegrass/Crabgrass Control 8656	turf: ornamental	0.75	
538-241	~1	Scotts Turf Starter Plus G	turf: golf course fairways	4 lb ai/acre	1
538-241	~1	Scotts Turf Starter Plus G	turf: ornamental	4 lb ai/acre	1
538-257	0.2	Scotts - ProTurf Fertilizer Plus Preemergent Weed Control II	turf: golf course	4 lb ai/acre	2
538-257	0.2	Scotts - ProTurf Fertilizer Plus Preemergent Weed Control II	turf: ornamental	4 lb ai/acre	2
55615-4	0.75	Wilbro Fertilizer with 0.75% Ronstar G	turf: golf course	4 lb ai/acre	1
55615-4	0.75	Wilbro Fertilizer with 0.75% Ronstar G	turf: ornamental	4 lb ai/acre	1
557-1966	0.69	ParEx Plus Ronstar G	turf: golf course	4 lb ai/acre	1

557-1966	0.69	ParEx Plus Ronstar G	turf: ornamental (parks)	4 lb ai/acre	1
557-1974	1.5	ParEx Fertilizer Plus 1.5% RonstarG	turf: golf course (fairways)	4 lb ai/acre	1
557-1974	1.5	ParEx Fertilizer Plus 1.5% Ronstar G	turf: lawns (but not home lawns)	4 lb ai/acre	1
557-1974	1.5	ParEx Fertilizer Plus 1.5% Ronstar G	turf: ornamental (parks)	4 lb ai/acre	1
557-2026	1	ParEx Fertilizer Plus 1% Ronstar G	turf: golf course	4 lb ai/acre	1
557-2026	1	ParEx Fertilizer Plus 1% Ronstar G	turf: lawns	4 lb ai/acre	1
557-2026	1	ParEx Fertilizer Plus 1% Ronstar G	turf: ornamental	4 lb ai/acre	1
67508-1	1	Ronstar 1% with Fertilizer G	turf: golf course	4 lb ai/acre	1
67508-1	1	Ronstar 1% with Fertilizer G	turf: ornamental	4 lb ai/acre	1
8660-17	1	Sta-Green G	turf: golf course	2.5	1
8660-17	1	Sta-Green G	turf: lawns	2.5	1
8660-36	1	Vertagreen Fertilizer with Ronstar G	turf: golf course	4 lb ai/acre	3
8660-36	1	Vertagreen Fertilizer with Ronstar G	turf: ornamental	4 lb ai/acre	3
9198-154	1	Andersons Fertilizer with 1% Ronstar and 0.125% Dimension G	turf: golf course (fairways and roughs)	4 lb ai/acre	3
9198-154	1	Andersons Fertilizer with 0.125% Dimension and 1.0% Ronstar G	turf: golf course (fairways)	2 lb ai/acre	3
9198-154	1	Andersons Fertilizer with 0.125% Dimension and 1.0% Ronstar G	turf: golf course (roughs)	1.5	3
9198-154	1	Andersons Fertilizer with 1% Ronstar and 0.125% Dimension G	turf: lawns	4 lb ai/acre	3
9198-154	1	Andersons Fertilizer with 1% Ronstar and 0.125% Dimension G	turf: ornamental	4 lb ai/acre	3
9198-75	1.38	Andersons Fertilizer with 1.38% Ronstar G	turf: golf course (fairways, tees)	4 lb ai/acre	
9198-75	1.38	Andersons Fertilizer with 1.38% Ronstar G	turf: golf course(fairways and tees)	4 lb ai/acre	
9198-75	1.38	Andersons Fertilizer with 1.38% Ronstar G	turf: lawns	4 lb ai/acre	
9198-75	1.38	Andersons Fertilizer with 1.38% Ronstar G	turf: ornamental	4 lb ai/acre	
9198-75	1.38	Andersons Fertilizer with 1.38% Ronstar G	turf: ornamental	4 lb ai/acre	
961-340	1.73	Lebanon Country Club with Ronstar G	landscape: woody ornamentals, shrubs, vines	4 lb ai/acre	3
961-340	1.73	Lebanon Country Club with Ronstar G	nursery: conifer	4 lb ai/acre	3
961-340	1.73	Lebanon Country Club with Ronstar G	nursery: woody ornamentals shrubs, trees, vines	4 lb ai/acre	3
961-340	1.73	Lebanon Country Club with Ronstar G	turf: golf course	4 lb ai/acre	1
961-340	1.73	Lebanon Country Club with Ronstar G	turf: ornamental (parks and gardens)	4 lb ai/acre	1
961-371	0.5	Lebanon Country Club with Ronstar G	turf: golf course	4 lb ai/acre	
961-371	0.5	Lebanon Country Club with Ronstar G	turf: ornamental	4 lb ai/acre	
CA-970018	50	Chipco Ronstar 50 WSP	landscape: specific ornamental crops	3 lb ai/acre	NS
CA-970018	50	Chipco Ronstar 50 WSP	nursery: specific ornamental crops	3 lb ai/acre	NS
FL-820045	2	Chipco Ronstar G	leatherleaf ferns	2 lb ai/acre	NS
HI-970001	2	Chipco Ronstar G	turf: Lalo	3 lb ai/acre	1

1.3 Methods and Types of Equipment Used for Mixing/Loading/Applying

The following use patterns are associated with the application equipment: chemigation, groundboom, rights-of-way sprayer, handgun sprayer, tractor drawn spreader, backpack sprayer, low pressure handwand, high pressure handwand lawn handgun, belly grinder and push type spreader. (**aerial application was voluntarily canceled by the registrant**)

1.4 Incident reports

The following data bases have been consulted for the poisoning incident data on the active ingredient oxadiazon[3].

I. Incident Data System

Please note that the following cases from the IDS do not have documentation confirming exposure or health effects unless otherwise noted.

Incident#6920-2

A pesticide incident occurred in 1998, when a man applied oxadiazon on a wet lawn. He

reported nausea, headache, and difficulty breathing. No further information on the disposition of the case was reported.

Incident#7424-1

A pesticide incident occurred in 1998, when oxadiazon was sprayed onto landscaping at a large apartment complex. Several individuals reported congestion, sore throat, running eyes, and hoarseness. No further information on the disposition of the case was reported.

Incident#8383-1

A pesticide incident occurred in 1998, when a man used oxadiazon for two weeks on the landscape of several properties. He reported hives over his entire body area, itching, and a swollen face. He experienced a rash that lasted for twenty-four hours. However, these effects only occurred on the last two days of use and may, instead, be a reaction to ibuprofen. He was seen by a physician. No further information on the disposition of the case was reported.

Incident#8383-2

A pesticide incident occurred in 1997, when an unknown person applied the product to grass around a home. A year and a half later, a man who has chronic fatigue syndrome, reported malaise. He now lives with his brother and reports developing acute symptoms whenever he returns to his home. No further information on the disposition of the case was reported.

Incident#8476-1

A pesticide incident occurred in 1999, when a golf course was treated. Several months later, a female employee reported respiratory irritation and muscle weakness. No further information on the disposition of the case was reported.

Incident#9413-1

A pesticide incident occurred in 1999, when a man mixed the product in his home and reported a seizure the next morning. Two days later he poured the chemical into a spreader and ten minutes later reported a seizure. This individual has a history of ongoing seizure and is taking medication for his condition. Physicians treating this case did not believe that the seizure were related to the pesticide exposure. No further information on the disposition of the case was reported.

Incident#10179-10

A pesticide incident occurred in 1996, when a teacher and his daughter reported headaches, dizziness, burning eyes and skin, coughing, sore throat and hoarseness after oxadiazon was applied to a school campus. No further information on the disposition of the case was reported. This same case is reported in the California data summary.

No consistent pattern of ill effects was seen in this relatively small number of incidents. There was some evidence of irritative and allergic effects to the skin and respiratory system.

II. Poison Control Center Data - 1993 through 1998

Results for the years 1993 through 1998 were acquired for 37 exposures to oxadiazon reported to Poison Control Centers. Cases involving exposures to multiple products are excluded. Only 4 cases were reported among children under six years of age and six cases among older children and adults exposed at their workplace. This was too few cases to warrant detailed analysis. None of these cases reported a serious outcome and only one of the occupational cases had a moderate outcome. There were 27 non-occupationally exposed cases among older children and adults.

III. California Data - 1982 through 1996

Detailed descriptions of 31 cases submitted to the California Pesticide Illness Surveillance Program (1982-1996) were reviewed. In 26 of these cases, oxadiazon was used alone or was judged to be responsible for the health effects. Only cases with a definite, probable or possible relationship were reviewed. Oxadiazon ranked 84th as a cause of systemic poisoning in California based on data for 1982 through 1994. Category includes cases where skin, eye, or respiratory effects were also reported.

IV. National Pesticide Telecommunications Network

On the list of the top 200 chemicals for which NPTN received calls from 1984-1991 inclusively, oxadiazon was ranked 192nd with 12 incidents in humans reported and 5 incidents in animals (mostly pets).

2.0 OCCUPATIONAL EXPOSURES

2.1 Handler Exposures & Assumptions

iii. Handler Exposure Scenarios

Exposure scenarios can be thought of as ways of categorizing the kinds of exposures that occur related to the use of a chemical. The use of scenarios as a basis for the exposure assessment is described in the *U.S. EPA Guidelines For Exposure Assessment* (U.S. EPA; Federal Register Volume 57, Number 104; May 29, 1992).

HED uses the term "Handlers" to describe those individuals who are involved in the pesticide application process. HED believes that there are distinct job functions or tasks related to applications and that exposures can vary depending on the specifics of each task. Job requirements (e.g., amount of chemical to be used in an application), the kinds of equipment used, the crop or target being treated, and the circumstances of the user (e.g., the level of protection used by an applicator) can cause exposure levels to differ in a manner specific to each scenario.

HED has developed a series of general descriptions for tasks that are associated with pesticide applications. Tasks associated with pesticide use (i.e., for "handlers") can generally be categorized using one of the following terms:

- **Occupational Mixer/loaders:** these individuals perform tasks in preparation for an application. For example, they would prepare dilute spray solutions and/or load/transfer solid materials (e.g., granulars) or dilute spray solutions into application equipment such as a groundboom tractor or planter prior to application.

- **Occupational Applicators:** these individuals operate application equipment during the application of oxadiazon to registered sites. These individuals can make applications using equipment such as groundboom sprayers or tractor-drawn spreaders for granular materials.

- **Occupational Mixer/loader/applicators:** these individuals are involved in the entire pesticide application process (i.e., they do all job functions related to a pesticide application event). These individuals would prepare a dilute spray solution and then also apply the solution. HED always considers some exposures to be mixer/loader/applicator exposures because of the equipment used and the logistics associated with such applications. For example, if one uses a small handheld device such as a 1 gallon low pressure handwand sprayer it is anticipated that one individual will mix a spray solution and then apply the solution because of labor and logistical considerations.

HED has determined that there are potential exposures to mixers, loaders, applicators, or other handlers during usual use-patterns associated with oxadiazon. Based on the use patterns and potential exposures described above, 14 major exposure scenarios are identified in this document to represent the extent of oxadiazon uses. These scenarios include: mixing/loading wettable powders for chemigation application (1a), mixing/loading wettable powders for groundboom application (1b), mixing/loading wettable powders for rights-of-way sprayer (1c), loading granular formulations (2), applying with a groundboom (3), applying with a rights-of-way sprayer (4), applying wettable-powders for handgun applicators (ORETF) (5), applying granular with a tractor drawn spreader (6), backpack sprayer (LCO) (7), low pressure handwand--wettable powder formulations (LCO) (8), high pressure handwand -- (wettable powder formulations) (9), lawn handgun (wettable powder formulations) (ORETF) (10), granulars with a push type spreader (ORETF) (11), granulars with a bellygrinder (LCO) (12).

In most cases, HED assesses the exposure and risk to mixer/loaders and applicators separately for tractor drawn applications (i.e. granular spreaders) in the RED chapter. This practice has evolved, not because it is believed that there are always separate job functions, but rather because of the limited amount of information regarding these practices along with limited exposure data.

For occupational RED chapters process, HED has adopted a methodology to present the

risks separately for some scenarios and combine others. Most of the hand- held equipment such as backpack sprayers, and push type granular spreaders are assessed as a combined function. With these types of small operations the mixing, loading, and applying are almost always carried out by the same individual and there are data available to estimate exposure from these activities. For equipment such as groundboom tractors, the applications is assessed separately from the individual who mixes and loads the formulated product. By separating the two job functions, HED can determine the most appropriate PPE or engineering control without requiring the handler to wear PPE throughout the entire workday or engineering controls that are not needed.

2.1.1 Summary of Occupational Handler Exposures

Table 4 presents the exposure scenarios, application rates, and area (i.e., acres) potentially treated that have been used in the exposure calculations. Oxadiazon labels include a multitude of uses and a range of application rates.

Chemical-specific data for assessing human exposures during pesticide handling activities were not submitted to the Agency in support of the reregistration of oxadiazon. Consequently it is the policy of the HED to use data from the Pesticide Handlers Exposure Database (PHED)[4] Version 1.1 to assess handler exposures for regulatory actions when chemical-specific monitoring data are not available.

PHED was designed by a task force of representatives from the U.S. EPA, Health Canada, the California Department of Pesticide regulation, and member companies of the American Crop Protection Association. PHED is a software system consisting of two parts -- a database of measured exposure values for workers involved in the handling of pesticides under actual field conditions and a set of computer algorithms used to subset and statistically summarize the selected data. Currently, the database contains values for over 1,700 monitored individuals (i.e., replicates)

Users select criteria to subset the PHED database to reflect the exposure scenario being evaluated. The subsetting algorithms in PHED are based on the central assumption that the magnitude of handler exposures to pesticides are primarily a function of activity (e.g., mixing/loading, applying), formulation type (e.g., wettable powders, granulars), application method (e.g., groundboom), and clothing scenarios (e.g., gloves, double layer clothing).

Once the data for a given exposure scenario have been selected, the data are normalized (i.e., divided by) by the amount of pesticide handled resulting in standard unit exposures (milligrams of exposure per pound of active ingredient handled). Following normalization, the data are statistically summarized. The distribution of exposure values for each body part (e.g., chest upper arm) is categorized as normal, lognormal, or "other" (i.e., neither normal nor lognormal). A central tendency value is then selected from the distribution of the exposure values for each body part. These values are the arithmetic mean for normal distributions, the geometric mean for lognormal distributions, and the median for all "other" distributions. Once selected, the

central tendency values for each body part are composited into a "best fit" exposure value representing the entire body.

The unit exposure values calculated by PHED generally range from the geometric mean to the median of the selected data set. To add consistency and quality control to the values produced from this system, the PHED Task Force has evaluated all data within the system and has developed a set of grading criteria to characterize the quality of the original study data. The assessment of data quality is based on the number of observations and the available quality control data. These evaluation criteria and the caveats specific to each exposure scenario are summarized in TableA4. While data from PHED provide the best available information on handler exposures, it should be noted that some aspects of the included studies (e.g., duration, acres treated, pounds of active ingredient handled) may not accurately represent labeled uses in all cases. HED has developed a series of tables of standard unit exposure values for many occupational scenarios that can be utilized to ensure consistency in exposure assessments.

The method of risk assessment for adult non-occupational/ residential handlers was essentially the same as that for occupational workers with similar application methods. The Residential SOPs (1997) and the Outdoor Residential Exposure Task Force (ORETF) study data were both used to estimate exposure and compared. After preliminary review by the Agency, the ORETF data was found to be equal or superior in quality to the data set from the *Standard Operating Procedures (SOPs) for Residential Exposure Assessments* (revised December 1999) currently used by the Agency. Some of these data may be combined, but they are used separately for this assessment.

Table 4: Exposure Variables for Uses ofOxadiazon

Exposure Scenario (Scenario #)	Crop Type	Application Rates (lb ai/acre)[a]	Daily Acres Treated[b]
Mixer/Loader Exposure			
Mixing/Loading Wettable Powders for Chemigation Application (1a)	sod farms	3	350
Mixing/Loading Wettable Powders for Groundboom Application (1b)	conifer nurseries, woody ornamentals	4	40
	herbaceous ornamentals	3	40
	sod farms	3	80
	golf courses	4	40
Mixing/Loading Wettable Powders for Rights-of-Way Sprayer (1c)	roadside turf, ornamentals	4	40
Loading Granular formulations (2)	sod farms, conifers forest.	4	80
	golf course turf, parks, recreational areas	4	40

Table 4: Exposure Variables for Uses ofOxadiazon			
Exposure Scenario (Scenario #)	**Crop Type**	**Application Rates (lb ai/acre)[a]**	**Daily Acres Treated[b]**
	woody ornamentals	4	40
Applicator			
Applying with a Groundboom (3)	sod farms	3	80
	herbaceous ornamentals	3	40
	golf courses	4	40
	conifer nurseries, woody ornamentals	4	40
Applying with a Rights-of-Way Sprayer (4)	roadsides	4	40
Applying Wettable-Powders for Handgun Applicators (ORETF) (5)	lawns, parks, recreational areas	4	5
Applying Granular with a Tractor Drawn Spreader (6)	sod farms	4	80
	golf courses	4	40
Mixer/Loader/Applicator			
Backpack Sprayer (LCO) (7)	lawns, golf courses, ornamentals nurseries	4	5
Low Pressure Handwand - Wettable Powder Formulations (LCO) (8)	lawns, golf courses, nursery stock	4	5
High Pressure Handwand -- (Wettable Powder Formulations) (9)	woody ornamentals, conifer nurseries.	4	5
Lawn Handgun (Wettable Powder Formulations) (ORETF) (10)	ornamentals, lawns, parks rec areas	4	5
Granulars with a Push Type Spreader (ORETF) (11)	lawns, golf courses, parks, recreational areas, ornamentals	4	5
Granulars with a Bellygrinder (LCO) (12)	golf courses, parks, rec areas.	4	1

[a] Application rates are the maximum or range found on oxadiazon labels

[b] Daily acres treated are based on HED's estimates of acreage that would be reasonably expected to be treated in a single day for each exposure scenario of concern.

LCO = lawn care operators

2.1.2 Summary of Uncertainties

The handler exposure assessments encompass all of the major uses of oxadiazon

throughout the country. It is difficult to assess all of the "typical" uses (i.e., actual or predominate application rates and farm sizes), and therefore, an assessment has been developed that is believed to be realistic and yet provides a reasonable certainty that the exposures are not underestimated. The assumptions and uncertainties are identified below to be used in risk management decisions:

- *Application Rates:* The application rates are the maximum allowable that were identified on the available product labels.

- *Amount Handled:* The daily acres treated are HED standard values (see Table 4). The values for groundboom applications in agriculture and on turf/ornamentals vary. Groundboom applications in an agricultural setting are based on an 80 acre day because the Agency believes it would take 8 hours to complete that type of application with common equipment and that acreage estimate for various crops is reasonable. On the other hand, the value for groundboom applications on golfcourse turf is based on treating 40 acres because that is the value calculated to represent a 18 hole course (they account for about 10% of all golf courses based on registrants comments and investigation by Agency personnel). The 40 acre value is not the maximum that can be treated on a single day given that the application equipment is likely capable of treating higher acreage. The daily limitation of 40 acres per day is based on the fact that an applicator would only treat a course a single time on any given day.

2.1.3 Calculations of Exposure

Potential daily dermal exposure is calculated using the following formula:

$$\text{Daily Dermal Exposure}\left(\frac{mg\ ai}{Day}\right) = \text{Dermal Unit Exposure}\left(\frac{mg\ ai}{lb\ ai}\right) \cdot \text{Max. Appl. Rate}\left(\frac{lb\ ai}{Acre}\right) \cdot \text{Max. Area Treated}\left(\frac{Acres}{Day}\right)$$

Potential daily inhalation exposure is calculated using the following formula:

$$\text{Daily Inhalation Exposure}\left(\frac{mg\ ai}{day}\right) =$$
$$\text{Unit Exposure}\left(\frac{\mu g\ ai}{lb\ ai}\right) \times \text{Conversion Factor}\left(\frac{1mg}{1{,}000\ \mu g}\right) \times \text{Use Rate}\left(\frac{lb\ ai}{A}\right) \times \text{Daily Acres Treated}\left(\frac{A}{day}\right)$$

These calculations of potential daily exposure to oxadiazon by handlers are used to calculate the absorbed doses and total risk to those handlers (see *Occupational Risk* section).

2.1.4 Calculation of Cancer

Cancer risk assessments for handler used baseline exposure scenarios and, as needed,

increasing levels of risk mitigation (PPE and engineering controls) to achieve cancer risks that are not of concern. Tables B1 to B4 in Appendix B present total cancer risk calculations at baseline, with various PPE (ie., single layer+ gloves and no respirator, double layer + gloves and no respirator, single layer+ gloves and respirator and double layer + gloves and respirator) and with engineering controls, respectively, for each exposure scenario.

The calculations of daily dermal and inhalation exposure to oxadiazon by handlers were used to calculate the daily dose, and hence the risks, to those handlers. Potential daily dermal exposure was calculated using the following formula:

$$\text{Daily Dermal Exposure}\left(\frac{\text{mg ai}}{\text{day}}\right) = \text{Unit Exposure}\left(\frac{\text{mg ai}}{\text{lb ai}}\right) \times \text{Use Rate}\left(\frac{\text{lb ai}}{\text{A}}\right) \times \text{Daily Acres Treated}\left(\frac{\text{A}}{\text{day}}\right)$$

Potential daily inhalation exposure was calculated using the following formula:

$$\text{Daily Inhalation Exposure}\left(\frac{\text{mg ai}}{\text{day}}\right) =$$
$$\text{Unit Exposure}\left(\frac{\mu\text{g ai}}{\text{lb ai}}\right) \times \text{Conversion Factor}\left(\frac{1\text{mg}}{1{,}000\ \mu\text{g}}\right) \times \text{Use Rate}\left(\frac{\text{lb ai}}{\text{A}}\right) \times \text{Daily Acres Treated}\left(\frac{\text{A}}{\text{day}}\right)$$

The daily dermal and inhalation doses were calculated using a 70 kg body weight using the following formulas:

$$\text{Daily Inhalation Dose}\left(\frac{\text{mg ai}}{\text{kg/day}}\right) = \text{Daily Inhalation Exposure}\left(\frac{\text{mg ai}}{\text{day}}\right) \times \left(\frac{1}{\text{Body Weight (kg)}}\right)$$

$$\text{Daily Dermal Dose}\left(\frac{\text{mg ai}}{\text{Kg/Day}}\right) = \text{Daily Dermal Exposure}\left(\frac{\text{mg ai}}{\text{Day}}\right) \times \left(\frac{1}{\text{Body Weight (Kg)}}\right) \times 0.09\ \text{Dermal Absorption Factor}$$

$$\text{Total Daily Dose} = \text{Daily Dermal Dose}\left(\frac{\text{mg}}{\text{kg/day}}\right) + \text{Daily Inhalation Dose}\left(\frac{\text{mg}}{\text{kg/day}}\right)$$

The lifetime average daily dose (LADD) was calculated using the following formula:

$$\text{LADD}\left(\frac{\text{mg}}{\text{kg/day}}\right) = \text{Daily Total Dose}\left(\frac{\text{mg}}{\text{kg/day}}\right) \times \left(\frac{\text{days worked}}{365\ \text{days per year}}\right) \times \left(\frac{35\ \text{years worked}}{70\ \text{year lifetime}}\right)$$

T
otal cancer risk was calculated using the following formula:

*Total Cancer Risk = LADD x Q1**

where $Q_1^* = 7.11x10^{-2}$ (mg/kg/day)$^{-1}$

The following assumptions and factors were used in order to complete this cancer risk assessment:

- The average body weight of 70 kg is used, representing a typical adult.
- Career duration is assumed to be 35 years. This represents a typical working lifetime.
- Lifetime is assumed to be 70 years.
- Dermal absorption is assumed to be 9 %, and inhalation absorption is assumed to be 100 percent of the oral dose. The dermal and inhalation doses were added together to represent total daily dose.
- The $Q1^*$ used in the cancer assessment was $7.11x10^{-2}$(mg/kg/day)$^{-1}$.
- Two exposure frequencies were used in the calculations, the first represented the maximum number of applications per site per season to represent private use (3), and the second frequency applied a factor of ten to the first frequency to represent commercial handlers making multiple applications per site per season (30).

The Agency has defined a range of acceptable cancer risks based on a policy memorandum issued in 1996 by then office director, Dan Barolo. This memo refers to a predetermined quantified "level of concern" for occupational carcinogenic risk. In summary, this policy memo indicates occupational carcinogenic risks that are 1 x 10^{-6} or lower require no risk management action. For those chemicals subject to reregistration, the Agency is to carefully examine uses with estimated risks in the 10^{-6} to 10^{-4} range to seek ways of cost-effectively reducing risks. If carcinogenic risks are in this range for occupational handlers, increased levels of personal protection would be warranted as is commonly applied with noncancer risk estimates (e.g., additional PPE or engineering controls). Carcinogenic risks that remain above 1.0 x 10^{-4} at the highest level of mitigation appropriate for that scenario remain a concern.

2.2 Risk From Handler Exposures

Using the daily dermal exposure scenarios identified in the exposure section, EPA calculated the potential risk to persons from handler exposures and post-application exposures to oxadiazon.

Potential dermal and inhalation daily exposures for occupational handlers were calculated using the following formulas (9% dermal absorption was assumed):

The daily dermal and inhalation doses were calculated using a 60 kg body weight using the following formulas:

$$Daily\ Inhalation\ Dose\left(\frac{mg\ ai}{kg/day}\right) = Daily\ Inhalation\ Exposure\left(\frac{mg\ ai}{day}\right) x \left(\frac{1}{Body\ Weight\ (kg)}\right) * 1\ (100\%)$$

$$Daily\ Dermal\ Dose\left(\frac{mg\ ai}{kg/Day}\right) = Daily\ Dermal\ Exposure\left(\frac{mg\ ai}{Day}\right) x \left(\frac{1}{Body\ Weight\ (kg)}\right) * 0.09\ (9\%)$$

The MOEs were calculated using the following formulas:

$$MOE = \frac{NOAEL\left(\frac{mg}{kg/day}\right)}{Dermal\ Daily\ Dose\left(\frac{mg}{kg/day}\right)}$$

$$MOE = \frac{NOAEL\left(\frac{mg}{kg/day}\right)}{Inhlation\ Daily\ Dose\left(\frac{mg}{kg/day}\right)}$$

A total MOE is also calculated because there is a common endpoint. The uncertainty factor of 100 is applied to all routes and exposure durations. Route specific data are available for the dermal and oral routes, and therefore, the following reciprocal MOE calculation is used:

1/((1/Dermal MOE) + (1/Inhalation MOE)

2.2.1 Risk From Handler Exposures

Handler exposure assessments are completed by EPA using a baseline exposure scenario and, if required, increasing levels of risk mitigation (PPE and engineering controls) to achieve a margin of exposure of 100 for dermal and inhalation exposure or cancer risk of 1.0×10^{-4} to 1.0×10^{-6}. Appendix A presents the short-term and intermediate term MOE calculations for baseline exposure plus the risk mitigation measures of personal protective equipment (PPE) and engineering controls using data from PHED and ORTEF for the uses of oxadiazon. Bayer crop science is a member of the ORETF so there are no data compensation issues associated with the use of this data. Appendix B Tables B1 to B4 presents the cancer risk calculations for baseline exposure plus the risk mitigation measures of personal protective equipment (PPE) and

engineering controls.

EPA calculated the baseline MOE (short-term and intermediate-term) and cancer for each of the exposure scenarios using the following **baseline** PPE assumptions:

- all occupational handlers are wearing footwear (socks plus shoes or boots).
- occupational mixers and loaders using open mixing techniques are wearing long-sleeved shirts, long pants, and no gloves.
- occupational applicators use open cab tractor-driven application equipment.
- occupational handlers (mixers, loaders, and applicators) who use hand-held application equipment are wearing long-sleeve shirts, long pants, and no gloves.

If the baseline short-term or intermediate-term MOE calculated using this baseline PPE was 100 or greater (since the NOAEL is based on data from animal studies) for an exposure scenario, then no further calculations were made. If the baseline short-term or intermediate-term MOE was less than 100 for any exposure scenario, an additional short-term or intermediate-term MOE was calculated based on increasing the level of PPE over the baseline PPE. HED calculated the additional PPE short-term or intermediate-term MOE for each occupational exposure scenario with a baseline total MOE of less than 100, using the following additional **PPE** assumptions:

- all occupational handlers are wearing footwear (socks plus shoes or boots)
- occupational mixers and loaders using open mixing techniques are wearing long-sleeved shirts and long pants and gloves; this represents **minimum PPE**
- occupational mixers and loaders using open mixing techniques are wearing long-sleeved shirts and long pants, coveralls and gloves; this represents **maximum PPE**
- occupational applicators who use open cab tractor-driven application equipment
- Also, if necessary, dust/mist respirator represented by 5-fold protection factor or an organic vapor respirator represented by a 10-fold protection factor are added to mitigate the risks.

If the additional-PPE short-term or intermediate-term MOE calculated using this additional-PPE was 100 or greater (the NOAEL is based on data from animal studies) for an exposure scenario, then no further calculations were made. If the additional-PPE short-term or intermediate-term MOE remained less than 100 for any occupational exposure scenario, an addition short-term or intermediate-term MOE was calculated based on mandatory use of engineering controls where feasible. Engineering controls are not available for occupational handlers (mixers, loaders, and applicators) who use hand-held application equipment. HED calculated the engineering-control short-term or intermediate-term MOE for each occupational exposure scenario with an additional-PPE short-term or intermediate-term MOE of less than 100, using the following **engineering control** assumptions:

- all occupational handlers are wearing footwear (socks plus shoes or boots).
- occupational mixers and loaders handling liquid formulations using a closed system

are wearing chemical-resistant gloves plus long-sleeved shirts and long pants.

- occupational mixers and loaders handling wettable powders using a closed system (water-soluble packages) are wearing long-sleeved shirts and long pants, and chemical-resistant gloves.
- occupational applicators who use tractor-driven application equipment are located in enclosed cabs are wearing long-sleeved shirts and long pants, and no gloves.

2.2.2 Summary of Handler MOEs and Cancer

Table 5 summarizes the numeric MOE values for both the short- and intermediate-term exposure durations. The MOEs are presented for baseline, PPE and engineering controls. Cancer values also summarized in Table 6 at different levels of mitigation. Baseline for non-cancer assessment represents long pants, long sleeved shirts and no gloves or respirator, PPE dermal unit exposure represents long pants, long shirts and gloves for scenarios 5, 7, 9 and long pants, long shirts gloves and double layer (50% protection) for scenarios 1a, 1b, 1c, and 8. PPE inhalation unit exposure represents dust/ mist respirator (80 % protection) for scenarios 1a, 1b, 1c, and 8.

Engineering Control dermal unit exposure scenarios includes long pants, long shirts, gloves and water soluble packages for scenario 1a.

The results of the **short and intermediate-term handler** assessments indicate that all potential exposure scenarios provide at least one application rate with a total MOE(s) greater than or equal to 100 at either the **baseline** (i.e., long pants, long sleeved shirts, no gloves) using open systems**, PPE** (i.e., long pants, long sleeved shirts, and chemical resistant gloves while using open systems) or using **engineering controls** (i.e., closed systems). In the majority of cases, it is dermal exposure rather than the inhalation exposure driving the total MOEs. In total, 37 MOEs were calculated for the various application rates. The total MOEs for all the scenarios range from 2 to 3000.

The results of the **Cancer** Risk indicate that the values range from 1.65E-2 to 4.66E-7 at the baseline (long pants, long shirts and no gloves), 2.56E-3 to 4.11E-7 at PPE1 (long pants, long shirts, gloves and no respirator), 2.40E-3 at PPE2 (long pants, long shirts, double layer, gloves and no respirator), 1.05E-3 to 1.98E-7 at PPE3 (long pants, long shirts, gloves and respirator), 8.90E-4 to 1.38E-07 at PPE4 (long pants, long shirts, double layer, gloves and respirator) and 9.92E-5 to 1.10E-8 at engineering control.

Table 5: Exposure Variables, MOEs for Uses of Oxadiazon												
Exposure Scenario (Scenario #)	Crop Type	App Rates (lb ai/acre)	Daily Acres Treated	Dermal MOEs			Inhalation MOEs			Total MOEs		
				Base line	PPE	Eng. Control	Base line	PPE	Eng. Control	Base line	PPE	Eng. Control
Mixer/Loader												
Mixing/Loading Wettable Powders for Chemigation Application (1a)	sod farms	3	350	2	59 gl,dl	780 wsp	16	80 resp	2900	2	35	610
Mixing/Loading Wettable Powders for Groundboom Application (1b)	conifer nurseries, woody ornamentals	4	40	14	380 gl,dl	NA	100	520 resp	NA	12	220	NA
	herbaceous ornamentals	3	40	18	510 gl,dl	NA	140	700 resp	NA	16	300	NA
	sod farms	3	80	9	260 gl,dl	NA	70	350 resp	NA	8	150	NA
	golf courses	4	40	14	380 gl,dl	NA	100	520 resp	NA	12	220	NA
Mixing/Loading Wettable Powders for Rights-of-Way Sprayer (1c)	roadside turf, ornamentals	4	40	14	380 gl,dl	NA	100	520 resp	NA	12	220	NA
Loading Granular formulations (2)	sod farms, conifers forest	4	80	3000	NA	NA	1300	NA	NA	920	NA	NA
	golf course turf, parks, recreational areas	4	40	6000	NA	NA	2600	NA	NA	1800	NA	NA
	woody ornamentals	4	40	6000	NA	NA	2600	NA	NA	1800	NA	NA
Applicator												
Applying with a Groundboom (3)	sod farms	3	80	2400	NA	NA	4100	NA	NA	1500	NA	NA
	herbaceous ornamentals	3	40	4800	NA	NA	8100	NA	NA	3000	NA	NA
	golf courses		40	3600	NA	NA	6100	NA	NA	2300	NA	NA

Table 5: Exposure Variables, MOEs for Uses of Oxadiazon												
Exposure Scenario (Scenario #)	Crop Type	App Rates (lb ai/acre)	Daily Acres Treated	Dermal MOEs			Inhalation MOEs			Total MOEs		
				Base line	PPE	Eng. Control	Base line	PPE	Eng. Control	Base line	PPE	Eng. Control
	conifer nurseries, woody ornamentals	4	40	3600	NA	NA	6100	NA	NA	2300	NA	NA
Applying with a Rights-of-Way Sprayer (4)	roadsides	4	40	38	130	NA	1200	1200	NA	37	120	NA
Applying Wettable-Powders for Handgun Applicators (ORETF) (5)	lawns, parks, recreational areas	4	5	See PPE	550 gl	NA	36000	36000	NA	See PPE	540	NA
Applying Granular with a Tractor Drawn Spreader (6)	sod farms	4	80	2500	NA	NA	1900	NA	NA	1100	NA	NA
	golf courses	4	40	5100	NA	NA	3800	NA	NA	2200	NA	NA
Mixer/Loader/Applicator												
Backpack Sprayer (LCO) (7)	lawns, golf courses, ornamentals nurseries	4	5	See PPE	160 gl	NA	1200	1200	NA	See PPE	140	NA
Low Pressure Handwand - Wettable Powder Formulations (LCO) (8)	lawns, golf courses, nursery stock	4	5	14	65 gl,dl	NF	33	160 resp	NF	10	46	NF
High Pressure Handwand -- (Wettable Powder Formulations) (9)	woody ornamentals, conifer nurseries.	4	5	See PPE	160 gl	NA	300	300	NA	See PPE	100	NA
Lawn Handgun (Wettable Powder Formulations) (ORETF) (10)	ornamentals, lawns, parks rec areas	4	5	560	NA	NA	580	NA	NA	280	NA	NA
Granulars with a Push Type Spreader (ORETF) (11)	lawns, golf courses, parks, recreational areas, ornamentals	4	5	1100	NA	NA	4800000	NA	NA	1100	NA	NA
Granulars with a Bellygrinder (LCO) (12)	golf courses, parks, rec areas.	4	1	200	NA	NA	2900	NA	NA	190	NA	NA

Baseline dermal unit exposure scenarios includes long pants, long shirts and no gloves. .
Baseline inhalation unit exposure represents no respirator
PPE dermal unit exposure includes long pants, long shirts and gloves for scenarios5, 7, and 9.
PPE dermal unit exposure includes long pants, long shirts gloves and double layer (50% protection) for scenarios 1a, 1b, 1c, and 8.
PPE inhalation unit exposure represents dust/ mist respirator (80 % protection) for scenarios 1a, 1b, 1c, and 8.
Engineering Control dermal unit exposure scenarios includes long pants, long shirts, gloves and water soluble packages for scenario 1a.
Engineering inhalation unit exposure represents no respirator

NA = Not applicable NF= not feasible gl = gloves dl = double layer wsp = water soluble packages resp = dust mist respirator

Table 6: Exposure Variables, Cancer for Uses of Oxadiazon									
Exposure Scenario (Scenario #)	Crop/Target	Appl Rates (lb ai/acre)	Daily Acres Treated	Cancer					
				Base line	PPE 1	PPE 2	PPE 3	PPE 4	Eng. Control
Mixer/Loader									
Mixing/Loading Wettable Powders for Chemigation Application (1a)	sod farms	3	350	1.65e-03/ 1.65e-02	2.56e-04/ 2.56e-03	2.40e-04/ 2.40e-03	1.05e-04/ 1.05e-03	8.90e-05/ 8.90e-04	4.92e-06/ 4.92e-05
Mixing/Loading Wettable Powders for Groundboom Application (1b)	conifer nurseries, woody ornamentals	4	40	2.51e-04/ 2.51e-03	3.89e-05/ 3.89e-04	3.65e-05/ 3.65e-04	1.60e-05/ 1.60e-04	1.36e-05/ 1.36e-04	7.49e-07/ 7.49e-06
	herbaceous ornamentals	3	40	1.88e-04/ 1.88e-03	2.92e-05/ 2.92e-04	2.74e-05/ 2.74e-04	1.20e-05/ 1.20e-04	1.02e-05/ 1.02e-04	5.62e-07/ 5.62e-06
	sod farms	3	80	3.77e-04/ 3.77e-03	5.84e-05/ 5.84e-04	5.48e-05/ 5.48e-04	2.39e-05/ 2.39e-04	2.03e-05/ 2.03e-04	1.12e-06/ 1.12e-05
	golf courses	4	40	2.51e-04/ 2.51e-03	3.89e-05/ 3.89e-04	3.65e-05/ 3.65e-04	1.60e-05/ 1.60e-04	1.36e-05/ 1.36e-04	7.49e-07/ 7.49e-06
Mixing/Loading Wettable Powders for Rights-of-Way Sprayer (1c)	roadside turf, ornamentals	4	40	2.51e-04/ 2.51e-03	3.89e-05/ 3.89e-04	3.65e-05/ 3.65e-04	1.60e-05/ 1.60e-04	1.36e-05/ 1.36e-04	7.49e-07/ 7.49e-06
Loading Granular formulations (2)	sod farms, conifers forest	4	80	3.28e-06/ 3.28e-05	3.10e-06/ 3.10e-05	2.68e-06/ 2.68e-05	1.28e-06/ 1.28e-05	8.63e-07/ 8.63e-06	2.20e-08/ 2.20e-07
	golf course turf, parks, recreational areas	4	40	1.64e-06/ 1.64e-05	1.55e-06/ 1.55e-05	1.34e-06/ 1.34e-05	6.42e-07/ 6.42e-06	4.31e-07/ 4.31e-06	1.10e-08/ 1.10e-07
	woody ornamentals	4	40	1.64e-06/ 1.64e-05	1.55e-06/ 1.55e-05	1.34e-06/ 1.34e-05	6.42e-07/ 6.42e-06	4.31e-07/ 4.31e-06	3.29e-08/ 3.29e-07
Applicator									
Applying with a Groundboom (3)	sod farms	3	80	2.00e-06/ 2.00e-05	2.00e-06/ 2.00e-05	1.73e-06/ 1.73e-05	1.41e-06/ 1.41e-05	1.14e-06/ 1.14e-05	4.94e-07/ 4.94e-06
	herbaceous ornamentals	3	40	1.00e-06/ 1.00e-05	1.00e-06/ 1.00e-05	8.67e-07/ 8.67e-06	7.06e-07/ 7.06e-06	5.71e-07/ 5.71e-06	2.47e-07/ 2.47e-06

Table 6: Exposure Variables, Cancer for Uses of Oxadiazon									
Exposure Scenario (Scenario #)	Crop/Target	Appl Rates (lb ai/acre)	Daily Acres Treated	Cancer					
				Base line	PPE 1	PPE 2	PPE 3	PPE 4	Eng. Control
	golf courses	4	40	1.34e-06/ 1.34e-05	1.34e-06/ 1.34e-05	1.16e-06/ 1.16e-05	9.42e-07/ 9.42e-06	7.61e-07/ 7.61e-06	3.29e-07/ 3.29e-06
	conifer nurseries, woody ornamentals	4	40	1.34e-06/ 1.34e-05	1.34e-06/ 1.34e-05	1.16e-06/ 1.16e-05	9.42e-07/ 9.42e-06	7.61e-07/ 7.61e-06	3.29e-07/ 3.29e-06
Applying with a Rights-of-Way Sprayer (4)	roadsides	4	40	8.07e-05/ 8.07e-04	2.60e-05/ 2.60e-04	2.00e-05/ 2.00e-04	2.40e-05/ 2.40e-04	1.80e-05/ 1.80e-04	NA
Applying Wettable-Powders for Handgun Applicators (ORETF) (5)	lawns, parks, recreational areas	4	5	See PPE	5.57e-06/ 5.57e-05	2.94e-06/ 2.94e-05	5.50e-06/ 5.50e-05	2.87e-06/ 2.87e-05	NA
Applying Granular with a Tractor Drawn Spreader (6)	sod farms	4	80	9.31e-07/ 9.31e-06	8.23e-07/ 8.23e-05	7.03e-07/ 7.03e-06	3.95e-07/ 3.95e-06	2.75e-07/ 2.75e-06	1.82e-07/ 1.82e-06
	golf courses	4	40	4.66e-07/ 4.66e-06	4.11e-07/ 4.11e-06	3.51e-07/ 3.51e-06	1.98e-07/ 1.98e-06	1.38e-07/ 1.38e-06	9.11e-08/ 9.11e-07
Mixer/Loader/Applicator									
Backpack Sprayer (LCO) (7)	lawns, golf courses, ornamentals nurseries	4	5	See PPE	2.13e-05/ 2.13e-04	1.45e-05/ 1.45e-04	1.93e-05/ 1.93e-04	1.25e-05/ 1.25e-04	NA
Low Pressure Handwand - Wettable Powder Formulations (LCO) (8)	lawns, golf courses, nursery stock	4	5	3.10e-04/ 3.10e-03	1.56e-04/ 1.56e-03	1.38e-04/ 1.38e-03	8.30e-05/ 8.30e-04	6.50e-05/ 6.50e-04	NA
High Pressure Handwand -- (Wettable Powder Formulations) (9)	woody ornamentals, conifer nurseries.	4	5	See PPE	1.88e05/ 1.88e-04	1.20e-05/ 1.20e-04	1.98e-05/ 1.98e-04	1.31e-05/ 1.31e-04	NA
Lawn Handgun (Wettable Powder Formulations) (ORETF) (10)	ornamentals, lawns, parks rec areas	4	5	1.06e-05/ 1.06e-04	1.06e-05/ 1.06e-04	8.03e-06/ 8.03e-05	6.44e-06/ 6.44e-05	3.89e-06/ 3.89e-05	NA
Granulars with a Push Type Spreader (ORETF) (11)	lawns, golf courses, parks, recreational areas, ornamentals	4	5	2.33e-06/ 2.33e-05	1.80e-06/ 1.80e-05	No data	1.80e-06/ 1.80e-05	No data	NA
Granulars with a Bellygrinder (LCO) (12)	golf courses, parks, rec areas.	4	1	1.61e-05/ 1.61e-04	1.50e-05/ 1.50e-04	9.60e-06/ 9.60e-05	1.42e-05/ 1.42e-04	8.77e-06/ 8.77e-05	NA

Baseline dermal unit exposure scenarios includes long pants, long shirts and no gloves.
PPE 1 cancer risk includes long pants, long shirts, gloves and no respirator.

PPE 2 cancer risk includes long pants, long shirts, double layer, gloves and no respirator.

PPE 3 cancer risk includes long pants, long shirts, gloves and respirator.
PPE 4 cancer risk includes long pants, long shirts, double layer, gloves and respirator.
Engineering Control dermal unit exposure scenarios includes long pants, long shirts, gloves and water soluble packages.
Engineering inhalation unit exposure represents no respirator.
Two exposure frequencies were used for cancer, the first represented the maximum number of applications per site per season to represent private use (3), and the second frequency applied a factor of ten to the first frequency to represent commercial handlers making multiple applications per site per season (30).
NA=Not applicable

3.0 POSTAPPLICATION EXPOSURES

3.1 Postapplication Exposure & Assumption

HED uses the term "post-application" to describe those individuals who can be exposed to pesticides after entering areas previously treated with pesticides and performing certain tasks or activities (also often referred to as reentry exposure). Most of the oxadiazon used in agriculture is applied either pre-plant or when the crops are quite small (early post-emergence). This fact, and the degree of mechanization, minimizes the postapplication contact of workers with oxadiazon. However, The Agency has determined that there are potential postapplication exposures to individuals re-entering oxadiazon treated areas for the purpose of:

- *Roadsides*: mowing
- *Bermuda grass rights-of-way*: mowing
- *Sod farms*: mowing and harvesting
- *Golf-course turfgrass*: mowing

3.1.1 Data Source and Assumptions for Scenario Considered

Although two transferable turf residues (TTR) studies (MRID# 449955-01and 449955-02) and one Jazzercize study (MRID# 435178-01) were submitted in support of the reregistration of oxadiazon, only the Jazzercize study found to be acceptable for this assessment. The TTR studies were reviewed and found to have TTR transfer efficiencies of less than1% (transfer efficiency = % of the application rate). TTR data generated by ORETF members rely on a modified version of the California roller (ORETF roller) that appears to have a much lower transfer efficiency (percent of application rate) than the original version. Many TTR data submitted by ORETF members show percent transferabilities of less than 1% of the application rate for sprayable formulations and less than 0.5% of the application rate for granular formulations. ORD has conducted a round robin test of TTR methods that included the ORETF roller (Fortune 1997). While ORD concluded that the ORETF roller performed the best of all methods, transfer efficiency for three liquid herbicide formulations indicated a transfer efficiency of ~0.5%. The ORETF data was not used with the revised Transfer Coefficients referenced in current residential SOP since these revised TCs are based on TTR transfer efficiencies of ~1-5% (transfer efficiency = % of the application rate). Therefore the TTR values from these studies are not included in this assessment.
The Jazzercize study (MRID # 435178-01) was reviewed and found to be acceptable for this assessment.

MRID 435178-01. *Evaluation of Turf Re-entry Exposure to a Broadcast Application of Ronstar® 50 WP, L.* Rosenheck (1995). Pan-Agricultural Labs, Inc. Number: 93293

Unpublished study prepared by Rhone Poulenc AG Company. 300 pages.

This study on turf-transferable residues (TTR) was submitted by Rhone Poulenc Ag Company, in response to an occupational/residential exposure Data Call-In, and in support of oxadiazon re-registration requirements. *Ronstar® 50 WP* a wettable powder product containing ~ 50 % oxadiazon, was applied to turf in North Carolina. The study was conducted in order to quantify the dermal exposure associated with re-entry onto oxadiazon treated turf. *Ronstar® 50 WP* which is labeled for use on dormant, Bermuda grass, St. Augustine grass and Zoisia turf in areas such as fairways, parks, and lawns was used at a maximum label rate of 3 .0 lb ai/A. Two different exposure scenarios were monitored:

a) Application at the maximum label rate followed by re-entry as soon as the turf was dry.
b) Application within 30 minuted by sprinkler irrigation of 1/10 inch of water with re-entry occurring as soon as the turf is dry.

Overall, the study met most criteria of the OPPTS Post-application Exposure Monitoring Test Guidelines, 875.2100, Transferable Residue Dissipation: Lawn and Turf.

Most of the field samples returned results that were <LOQ for oxadiazon,. No LOD value was defined in the study, however. The overall mean recovery for field fortification samples of oxadiazon ranged between 64.7 to 99.6%. On Day 0, the highest average turf-transferable residues (TTR) for non-irrigated plot was **1.22** µg per cm^2 and **0.694** µg per cm^2 on irrigated plot. The TTR values adjusted for an application rate of 4.0 lb ai/A.

The TTR value from the above study utilized a wettable powder formulation which by far has a higher potential for exposure than the oxadiazon granular formulations. Since 91% of the total use involves granular formulations, using wettable powder TTR values is a conservative approach and can be considered the upper level estimates of exposure.

A linear regression to calculate a dissipation rate (T½) for oxadiazon TTR from irrigated and non-irrigated test sites was performed, using all non-zero, uncorrected, averaged data point from DAT-0 through DAT-7. Calculated dissipation half-lives for the irrigated plot was 1.7days (R^2=0.64) and for the non- irrigated plot was 1.4 days (R^2=0.64)

3.1.2 Assumptions Used in Postapplication Exposure Calculations

Based on data submitted for reregistration, the most common postapplication exposures will occur for workers on turf. Based on label restrictions and pattern of use, oxadiazon is applied early in the season, either pre-plant or before weeds emerge (pre-emergence). Mowing would be a common postapplication activity after either spraying method. Treated turf or grasses will routinely require reentry activities, such as mowing and watering, and eventually harvesting in the case of sod farms.

Because oxadiazon has a low vapor pressure (1.0×10^{-6}mm Hg) and is only used outdoors, the inhalation component of postapplication exposure is anticipated to be negligible. Therefore, all

calculations of postapplication risk estimates have been done for dermal exposure only. Postapplication exposure via the inhalation route is considered to be negligible.

3.1.3 Exposure and Risk Calculations

Short- and intermediate-term daily absorbed doses and MOEs were calculated as follows:

$$Dose\ (mg/kg/d) = \frac{(DFR\ (\mu g/cm^2)\ x\ Tc\ (cm^2/hr)\ x\ CF\left(\frac{1\ mg}{1{,}000\ \mu g}\right)\ x\ Abs\ x\ ED\ (hrs/day))}{BW}$$

Where:

DFR	=	daily DFR, as calculated above for the assumed average reentry day
Tc	=	transfer coefficient;
CF	=	conversion factor (i.e., 1 mg/1,000 μg)
Abs	=	dermal absorption (9%)
ED	=	exposure duration; 8 hours worked per day
BW	=	body weight (60 kg)

Dermal MOEs were calculated as follows:

$$MOE = \frac{NOAEL\ (mg/kg/day)}{Dose\ (mg/kg/day)}$$

Where:

NOAEL	=	12 mg/kg/day for short-term and intermediate-term
Dose	=	calculated absorbed dermal dose

For the purposes of occupational risk assessments, the following residue values were chosen:

- For short-term and intermediate-term postapplication turf activities, the Residential SOP standard 5% of the amount ai applied is used, along with standard transfer coefficients (updated 8/2000).

3.1.4 Postapplication Exposure Risk Estimates

For turf or sod mowing and harvesting, transfer coefficients of 500 and 16,500 cm^2/hr were used, based on the ARTF data (see HED Exposure SAC Policy guidance 3.1, 8/00). As shown in Table C1, short and intermediate -term exposure had an estimated MOEs of 30-1,000. Similarly occupational post application cancer risks were estimated to fall within the acceptable range of 1 x 10^{-4} to 1 x 10^{-6}. Residential SOP standard value of 5% of application rate used.(see Appendix C,

Table C1)

3.2 Non-Occupational Postapplication Exposures and Risk Estimates

The Agency has determined that there are potential postapplication exposures to residents entering oxadiazon treated lawns, either as a result of commercial or private application.

3.2.1 Postapplication Exposure Scenarios

The scenarios likely to result in postapplication exposures are presented below. The duration of postapplication dermal exposure is expected to be either short-term or intermediate-term, based on oxadiazon turf residue dissipation data. As calculated from the previously discussed Jazzercise study (MRID # 435178-01), oxadiazon has a half-life on turf of up to 1.4 days (irrigated) and 1.7 days (non- irrigated) after spraying, requiring several days to dissipate to non detectable levels of transferable residues. Because the label prohibits application more than 3 times per year, and even with the slow dissipation rates, it is not expected that individual residential exposure duration would exceed 30 days in duration. Exposure on a residential lawn would diminish continuously with time, while exposure through recreation turf contact would be more like random intermittent events of varying doses, all less than the dose predicted in this assessment. The resulting risk estimates are summarized in **Tables C2 (non-cancer)** and **C3 (cancer)**. Residential postapplication exposure assessments assumed residents wear the following attire: short sleeved shirt, short pants, shoes and socks, and no gloves or respirator. As stated in the occupational postapplication risk section of this document, negligible oxadiazon inhalation exposure is anticipated for non-handlers, due to low chemical vapor pressure and dilution of vapor outdoors. The scenarios likely to result in postapplication exposures are as follows:

- dermal postapplication risks to adults and toddlers when entering oxadiazon treated turf and lawns;

- oral postapplication risks to toddlers from “hand-to-mouth” (i.e., ingestion of grass, soil, granular pellets, or hand-to-mouth contact) exposure when reentering lawns treated with granular and wettable powder formulations.

Representative turf reentry activities include, but are not limited to:

(1) Adults involved in a low exposure activity, such as golfing or walking on treated turf.
(2) Toddlers involved in a low exposure activity, such as walking on treated turf.
(3) Adults mowing or other moderate contact activity, for 1-2 hours.
(4) Adults involved in a high exposure activity, such as heavy yard work (doses similar to occupational scenarios for cutting and harvesting sod)**.**
(5) Toddlers involved in high exposure activities on turf.

3.2.2 Data Sources for Scenarios Considered

A turf re-entry exposure study (Jazzercise study), using a spray application, was described in the Occupational Postapplication exposure section of this document. As the study was found to be acceptable for the risk assessment, the highest mean residues were also used to estimate short-term (DAT 0-1) for irrigated and non-irrigated plots.

Only limited information was received regarding the size and distribution of granular formulations. This information would help to refine or characterize the estimate of potential risk from episodic incidental ingestion of granules beyond the current screening level. If the particles are very fine, individual grains would be difficult to pick up, or even to see when applied on a lawn. If used according to label directions, it is unlikely that oxadiazon granules would be accessible to a child. However, larger granules or pellets of a few millimeters diameter might be attractive and easily picked up by a toddler.

3.2.3 Assumptions Used in Postapplication Exposure Calculations

Dermal Exposure to Golf Course Turfgrass

According to a 1992 report from *The Center For Golf Course Management*, 12.2 percent of the population are golfers (i.e., 28.5 million people). Golfing is considered a lifetime sport so individuals of all ages, excluding very small children, routinely play. Children who are 12 years of age or older are likely to represent the vast majority of the youth that play golf on any sort of routine basis. However, the popularity of golf as a recreational pastime has increased steadily over the last few years which has resulted in more and more young children (i.e., less than 12 years old for this discussion) becoming involved in the sport. Risk assessments for these age children are more difficult to complete because of the increased uncertainties associated with any extrapolations using adult dermal exposure data and because of the increased likelihood that other behaviors that might contribute to exposure such as mouthing contaminated hands or golf balls.

Dermal exposures are calculated using the standard transfer coefficient approach that is used for postapplication exposure assessments.

$ADD_{(t)}$ (mg/kg/day) = (($TTR_{(t)}$ (μg/cm^2) x TC (cm^2/hr) x ET(hr/day) x (1 mg/1000 μg))/(BW (kg))

Where:

ADD = average daily dose (mg/kg/day) at time (t) attributable to golfing on previously treated turf (mg/kg/day);
$TTR_{(t)}$ = turf transferable residue at time (t) (μg/cm^2);
TC = transfer coefficient (cm^2/hour);
ET = exposure duration (hours); and
BW = body weight (kg).

- Duration is 4 hours for a chemical that can be used on all parts of a course (greens, tees, and fairways). This estimate of the average time it takes to play a round of golf which is based on the report completed by the Center For Golf Course Management *[1992 Golf Course Operations: Cost of Doing Business/Profitability*. Library of Congress GV975.G56 1992].

- The dose levels calculated for adult golfers can be considered upper level estimates of exposure because of several reasons including the clothing scenario considered (i.e., shorts and short-sleeved shirts are not worn by all golfers), combining average values across several input parameters mathematically results in an upper percentile calculated product.

- Children of various ages down to the very young (e.g., 4 or 5 years old) are currently playing golf, the agency recognize this but has not yet developed a quantitative approach for calculating their risk, based to analysis of surface area to body weight ratio it appears that the dose for these children may be as much as 1.7 times than for adults.

Dermal Exposure values on each day after application were calculated based on the following equation (see Residential 2.2 (1997): Postapplication dermal potential dose from pesticide residues on turf):

$DE_{(t)}$ (mg/day) = ($TTR_{(t)}$ (μg/cm^2) x TC (cm^2/hr) x Hr/Day)/1000 (μg/mg)

Where:

DE = Dermal exposure at time (t) attributable for activity in a previously treated area (mg/day);
TTR = Turf Transferable Residue at time (t) where the longest duration (t) is dictated by the kinetics observed in the TTR study;
TC = Transfer Coefficient; and
Hr = Exposure duration in hours.

The activities that were selected as the basis for the risk assessment are represented by the following transfer coefficients (for short-term and intermediate-term endpoints):

- **Transfer Coefficient = 500 cm^2/hour** for adults involved in a low exposure activity on turf such as golfing or light work activities; based on Policy Memo # 003 .1 "Agricultural Transfer Coefficients," Revised - August 7, 2000..
- **Transfer Coefficient = 14,500 cm^2/hour** for adults involved in a high exposure activity on turf such as heavy yard work; Based on the revised residential SOP - February 2001
- **Transfer Coefficient = 5200 cm^2/hour** for toddler involved in a high exposure activity on turf such as heavy yard work; Based on the revised residential SOP - February 2001
- **Transfer Coefficient = 7,400 cm^2/hour (non-irrigated)** for adults involved in a high exposure activity on turf such as heavy yard work; Based on the submitted re-entry study (MRID # 435178-01)
- **Transfer Coefficient = 4,300 cm^2/hour (irrigated)** for adults involved in a high exposure activity on turf such as heavy yard work; Based on the submitted re-entry study (MRID # 435178-01) and
- **Transfer Coefficient = 2,700 cm^2/hour (non-irrigated)** for toddlers involved in a high exposure activity. Based on the submitted re-entry study (MRID # 435178-01)
- **Transfer Coefficient = 1,600 cm^2/hour (irrigated)** for toddlers involved in a high exposure

activity. Based on the submitted re-entry study (MRID # 435178-01)

- **Transfer Coefficient = 16,500 cm^2/hour** for sod harvesting (hand or mechanical); based on Policy Memo # 003 .1 "Agricultural Transfer Coefficients," Revised - August 7, 2000.

The Agency's Residential SOPs contains guidance for considering children's exposure to treated turf. The dermal calculations, as noted above, were completed based on the guidance provided in the document. All nondietary exposures were also calculated using guidance from this document. Specifically, the kinds of nondietary exposures that were considered in this assessment include the following:

- **Dose from hand to mouth activity calculated using Residential SOP 2.3.2:** Postapplication potential dose among toddlers from incidental nondietary ingestion of pesticide residues on residential lawns from hand-to-mouth transfer.
- **Dose from mouthing treated turf calculated using Residential SOP 2.3.3:** Postapplication potential dose among toddlers from the ingestion of pesticide treated turfgrass; and
- **Dose from incidental ingestion of soil calculated using Residential SOP 2.3.4:** Postapplication potential dose among toddlers from the ingestion of soil in pesticide treated areas.

Although incidental exposures incurred by hand-to-mouth exposure are included as part of the nondietary risk assessment, these type of exposures are considered *episodic* in nature. The hand-licking, mouthing of turf, and eating of soil are considered more likely to co-occur, with the hand-licking constituting the largest incidental oral exposure component.

The following demonstrates the method used to calculate exposures that are attributable to a child touching treated turf and then putting their hands in their mouth (SOP 2.3.2):

$$PDR = (DFR * SA * Freq * Hr * (1mg/1000\mu g))$$

where:

PDR =	potential dose rate (mg/day)
DFR(t)=	Dislodgeable Residue (5%) on day of treatment ($\mu g/cm^2$);
SA =	surface area of two fingers (cm^2);
Freq =	frequency of hand-to-mouth events (events/hour); and
Hr =	exposure duration (hours).

As indicated above, the dislodgeable foliar residue represents the amount of pesticide that can be removed from turf by the (potentially wet) hands of a child, while the turf transferable residue represents the amount of chemical on the surfaces of treated leaves that can rub off on dry skin or clothing. These observations are based on empirical data, and therefore the Residential SOP standard 5% of the amount ai applied is used, rather than the data from the TTR study. The surface area for 1-3 fingers used (20 cm^2) is the median surface area for a toddler (age 3 years) as updated by the SAP in 12/99. The frequency of hand-to-mouth events is 20 events per hour as

updated in 12/99. The 2 hour duration value is a recommended value from the U.S. EPA Exposure Factors Handbook. This model for hand-to-mouth dose is based on the premise that a child puts 2-3 fingers in their mouths, 50% of the residues on the hands are transferred from the hands to the mouth, and that all of the dislodgeable residues available on the treated turf transfer to the child's hand each time they exhibit this behavior.

The following illustrates the approach used to calculate exposures that are attributable to a child mouthing treated turf (SOP 2.3.3):

$$PDR = (DFR * IgR * (1mg/1000\mu g))$$

where:

PDR = potential dose rate (mg/day);

DFR(t)= Dislodgeable Foliar Residue (DFR) at time (t) where the longest duration (t) is dictated by the kinetics observed in the TTR study ($\mu g/cm^2$); and

IgR= ingestion rate for mouthing of grass per day (cm^2/day).

The ingestion rate used (25 cm^2/day) assumes that a child will grab a handful of turf, mouth it and remove all oxadiazon residues, and then remove it from their mouth as described in the Residential SOPs. The standard time period is 2 hours, as explained above. The surface area of (25 cm^2/day) is thought to approximate a handful of turf that is mouthed. The maximum average TTR values were used for this scenario.

Incidental Soil Ingestion:

$$PDR = (SR_t * IgR * CF1)$$

where:

PDR = potential dose rate (mg/day)

SR_t = soil residue on day "t" ($\mu g/g$), assuming average day of reentry "t" is day 0

IgR = ingestion rate of soil (mg/day), assumed to be 100 mg/day

CF1 = weight unit conversion factor to convert the μg of residues on the soil to grams to provide units of mg/day (1E-6 g/μg)

and

$$SR_t = AR * F * (1-D)^t * CF2 * CF3 * CF4$$

where:

AR = application rate (lb ai/acre)

F = fraction of ai available in uppermost cm of soil (fraction/cm), assumed to be 100 percent based on soil incorporation into top 1 cm of soil after application

D = fraction of residue that dissipates daily (unitless)

t = postapplication day on which exposure is being assessed

CF2 = weight unit conversion factor to convert the lbs ai in the application rate to μg for

the soil residue value (4.54×10^8 μg/lb)

CF3 = area unit conversion factor to convert the surface area units (ft^2) in the application rate to cm^2 for the SR value (2.47×10^{-8} acre/cm^2 if the application rate is per acre)

CF4 = volume to weight unit conversion factor to convert the volume units (cm^3) to weight units for the SR value (0.67 cm^3/g soil)

t = postapplication day on which exposure is being assessed, assumed to be day zero

The following specific assumptions and factors were used in order to complete this exposure assessment:

- These assessments were based on the guidance provided in the Residential SOPs. Several of the assumptions and factors used in the exposure assessment are described in that document.

- The TTR values are assumed to be 5 percent of the application rate at day 0 for turfgrass application (the 5 percent rate for turfgrass is the high end of the values observed in Hurto and Prinster, 1993, Goh et al., 1986, and Cowell et al., 1993,

- Calculations are completed at the maximum application rates recommended by the available oxadiazon labels to bracket risk levels associated with the various use patterns and activity scenarios.

- Due to a lack of scenario-specific exposure data, HED has calculated exposure values for adults using surrogate dermal transfer coefficients that represent activities such as mowing, golfing, and yard work. Most of the transfer coefficients used are based on data submitted by the ARTF and ORETF and are reflected in the revised HED exposure guidance Policy 3.1 (8/2000).

- For the short- and intermediate-term risk assessment, the equations and assumptions used for each of the scenarios were taken from the Residential SOPs guidance document.

- Adults were assumed to weigh 60 kg for the short and intermediate-term postapplication dermal dose estimate. Toddlers (3 years old) were assumed to weigh 15 kg.

- Postapplication exposure is generally assessed on the same day the pesticide is applied because it is assumed that the resident could be exposed to turf immediately after application.

- A dermal absorption factor of 9 % was used in the calculation of short and intermediate-term postapplication dermal dose. MOEs were calculated using the same formula (NOAEL divided by absorbed dermal dose) described in the residential

handler portion of this chapter, and are considered to be below the level of concern when results are greater than 100.

3.2.4 Postapplication Exposure Risk Estimates

Using the revised residential SOP postapplication short- and intermediate-term dermal risk estimates for occupational workers are between 30 and 1,000. The cancer risk for all occupational handlers is between 9.92×10^{-5} to $3.01 \times 10^{-6.}$

Dermal postapplication exposure estimates were conducted using the highest mean postapplication residue from the Jazzercise study(wettable powder formulations). The dermal transfer coefficients from the Jazzercize study and the revised residential SOPs were used. Using the Jazzercize wettable powder application study residue data and revised residential SOPs , all of the scenario had short-term and intermediate-term dermal MOEs greater than 100 on the application day **(i.e.,day 0)**. The cancer risks for all residential dermal postapplication is between $6.22x\ 10^{-6}$ to 7.51×10^{-7} .

The Residential SOPs and submitted Jazzercize study data were used to estimate incidental oral exposure for toddlers on treated turf. The short-term MOE was100 for the toddler hand-to-mouth using residential SOPs and between 90 to 240 for the submitted Jazzercize study, however since wettable powder formulation has a higher exposure than granular formulation, therefore the MOE,s can be considered upper level estimates of exposure. The intermediate-term MOE was not calculated since exposure by this route for weeks to months is considered less likely to occur than short-term exposure. Incidental turfgrass mouthing and soil ingestion had MOEs greater than 100 for short-term exposures (see Appendix C Table C4).

Under the Worker Protection Standard (WPS), interim restricted entry intervals (REI) for all uses within the scope of the WPS are based on the acute toxicity of the active ingredient. The toxicity categories of the active ingredient for acute dermal toxicity, eye irritation potential, and skin irritation potential are used to determine the interim WPS REI. If one or more of the three acute toxicity effects are in toxicity category I, the interim WPS REI is established at 48 hours. If none of the acute toxicity effects are in category I, but one or more of the three is classified as category II, the interim WPS REI is established at 24 hours. If none of the three acute toxicity effects are in category I or II, the interim WPS REI is established at 12 hours.(all of the three oxadiazon acute toxicity effects are in category III)

3.2.5 Data Gaps and Uncertainties

The following data gap or uncertainties were associated with this assessment:

- Granular ingestion is considered episodic, rather than continuous, in nature.

APPENDIX A

SHORT- TERM AND INTERMEDIATE- TERM HANDLER EXPOSURE RISK

TABLES A1 THROUGH A4

Table A1: Occupational Handler Short-term and Intermediate-term Risk from Oxadiazon at Baseline

Exposure Scenario (Scenario #)	Crop type	Baseline Dermal			Baseline Inhalation			Total MOE[g]
		Unit Exposure (mg/lb ai)[a]	Daily Dose (mg/kg/day)[b]	Dermal MOE[c]	Unit Exposure (ug/lb ai)[d]	Daily Dose (mg/kg/day)[e]	Inhalation MOE[f]	
Mixer/Loader Exposure								
Mixing/Loading Wettable Powders for Chemigation Application (1a)	sod farms	3.7	5.8	2.0	43	0.75	16	2
Mixing/Loading Wettable Powders for Groundboom Application (1b)	conifer nurseries, woody ornamentals		0.89	14		0.11	100	12
	herbaceous ornamentals		0.67	18		0.086	140	16
	sod farms		1.3	9		0.17	70	8
	golf courses		0.89	14		0.11	100	12
Mixing/Loading Wettable Powders for Rights-of-Way Sprayer (1c)	roadside turf, ornamentals		0.89	14		0.11	100	12
Loading Granular formulations (2)	sod farms, conifers forest	0.0084	0.004	3000	1.7	0.0091	1300	920
	golf course turf, parks, recreational areas		0.002	6000		0.0045	2600	1800
	woody ornamentals		0.002	6000		0.0045	2600	1800
Applicator								
Applying with a Groundboom (3)	sod farms	0.014	0.005	2400	0.74	0.003	4100	1500
	herbaceous ornamentals		0.0025	4800		0.0015	8100	3000
	golf courses		0.0034	3600		0.002	6100	2300
	conifer nurseries, woody ornamentals		0.0034	3600		0.002	6100	2300
Applying with a Rights-of-Way Sprayer (4)	roadsides	1.3	0.31	38	3.9	0.01	1200	37

Table A1: Occupational Handler Short-term and Intermediate-term Risk from Oxadiazon at Baseline

Exposure Scenario (Scenario #)	Crop type	Baseline Dermal			Baseline Inhalation			Total MOE[g]
		Unit Exposure (mg/lb ai)[a]	Daily Dose (mg/kg/day)[b]	Dermal MOE[c]	Unit Exposure (ug/lb ai)[d]	Daily Dose (mg/kg/day)[e]	Inhalation MOE[f]	
Applying Wettable-Powders for Handgun Applicators (ORETF) (5)	lawns, parks, recreational areas	See PPE	See PPE	See PPE	1	0	36000	See PPE
Applying Granular with a Tractor Drawn Spreader (6)	sod farms	0.0099	0.0048	2500	1.2	0.0064	1900	1100
	golf courses	0.0099	0.0024	5100	1.2	0.0032	3800	2200
Mixer/Loader/Applicator								
Backpack Sprayer (LCO) (7)	lawns, golf courses, ornamentals nurseries	See PPE	See PPE	See PPE	30	0.01	1200	See PPE
Low Pressure Handwand - Wettable Powder Formulations (LCO) (8)	lawns, golf courses, nursery stock	29	0.87	14	1100	0.37	33	10
High Pressure Handwand -- (Wettable Powder Formulations) (9)	woody ornamentals, conifer nurseries.	See PPE	See PPE	See PPE	120	0.04000	300	See PPE
Lawn Handgun (Wettable Powder Formulations) (ORETF) (10)	ornamentals, lawns, parks rec areas	0.99	0.022	560	62	0.021	580	280
Granulars with a Push Type Spreader (ORETF) (11)	lawns, golf courses, parks, recreational areas, ornamentals	0.35	0.011	1100	0.0075	2.50e-06	4800000	1100
Granulars with a Bellygrinder (LCO) (12)	golf courses, parks, rec areas.	10	0.06	200	62	0.0041	2900	190

[a] Baseline dermal unit exposure scenarios includes long pants, long shirts and no gloves.

[b] Daily Dermal Dose (mg/kg/day) = Daily Dermal Exposure (mg/day)/ Body weight (60 kg)* Dermal Absorption Factor (9%) .

[c] Short-term **or** Intermediate-term Dermal MOE = NOAEL (12 mg/kg/day)/ Daily Dermal Dose (mg/kg/day).

[d] Baseline inhalation unit exposure represents no respirator

[e] Daily Inhalation Dose (mg/kg/day) = Daily Inhalation Exposure (mg/day)/ Body weight (60 kg).

[f] Short-term **or** Intermediate-term Inhalation MOE = NOAEL (12 mg/kg/day)/ Daily Inhalation Dose (mg/kg/day).

[g] Total Dermal MOE = 1/ ((1/ Dermal MOE) + (1/ Inhalation MOE)).

Table A2: Occupational Handler Short-term and Intermediate-term Risk from Oxadiazon at PPE

Exposure Scenario (Scenario #)	Crop type	PPE Dermal			PPE Inhalation			Total MOE[g]
		Unit Exposure (mg/lb ai)[a]	Daily Dose (mg/kg/day)[b]	Dermal MOE[c]	Unit Exposure (ug/lb ai)[d]	Daily Dose (mg/kg/day)[e]	Inhalation MOE[f]	
Mixer/Loader Exposure								
Mixing/Loading Wettable Powders for Chemigation Application (1a)	sod farms	0.13 (gl, dl)	0.2	59	8.6 dust/ mist respirator	0.15	80	35
Mixing/Loading Wettable Powders for Groundboom Application (1b)	conifer nurseries, woody ornamentals		0.031	380		0.023	520	220
	herbaceous ornamentals		0.023	510		0.017	700	300
	sod farms		0.047	260		0.034	350	150
	golf courses		0.031	380		0.023	520	220
Mixing/Loading Wettable Powders for Rights-of-Way Sprayer (1c)	roadside turf, ornamentals		0.031	380		0.023	520	220
Loading Granular formulations (2)	sod farms, conifers forest	NA	NA	NA	NA	NA	NA	NA
	golf course turf, parks, recreational areas		NA	NA		NA	NA	NA
	woody ornamentals		NA	NA		NA	NA	NA
Applicator								
Applying with a Groundboom (3)	sod farms	NA	NA	NA		NA	NA	NA
	herbaceous ornamentals		NA	NA		NA	NA	NA
	golf courses		NA	NA		NA	NA	NA
	conifer nurseries, woody ornamentals		NA	NA		NA	NA	NA
Applying with a Rights-of-Way Sprayer (4)	roadsides	0.39 (gl)	0.094	130	3.9 (no resp)	0.01	1200	120

Table A2: Occupational Handler Short-term and Intermediate-term Risk from Oxadiazon at PPE

Exposure Scenario (Scenario #)	Crop type	PPE Dermal			PPE Inhalation			Total MOE[g]
		Unit Exposure (mg/lb ai)[a]	Daily Dose (mg/kg/day)[b]	Dermal MOE[c]	Unit Exposure (ug/lb ai)[d]	Daily Dose (mg/kg/day)[e]	Inhalation MOE[f]	
Applying Wettable-Powders for Handgun Applicators (ORETF) (5)	lawns, parks, recreational areas	0.73 (gl)	0.022	550	1.0 (no resp)	0.00030	36000	540
Applying Granular with a Tractor Drawn Spreader (6)	sod farms	NA	NA	NA	NA	NA	NA	NA
	golf courses	NA	NA	NA	NA	NA	NA	NA
Mixer/Loader/Applicator								
Backpack Sprayer (LCO) (7)	lawns, golf courses, ornamentals nurseries	2.5 (gl)	0.075	160	30 (no resp)	0.01	1200	140
Low Pressure Handwand - Wettable Powder Formulations (LCO) (8)	lawns, golf courses, nursery stock	6.2 (gl dl)	0.19	65	220 dust/ mist resp	0.073	160	46
High Pressure Handwand -- (Wettable Powder Formulations) (9)	woody ornamentals, conifer nurseries.	2.5 (gl)	0.075	160	120 (no resp)	0.040	300	100
Lawn Handgun (Wettable Powder Formulations) (ORETF) (10)	ornamentals, lawns, parks rec areas	NA	NA	NA	NA	NA	NA	NA
Granulars with a Push Type Spreader (ORETF) (11)	lawns, golf courses, parks, recreational areas, ornamentals	NA	NA	NA	NA	NA	NA	NA
Granulars with a Bellygrinder (LCO) (12)	golf courses, parks, rec areas.	NA	NA	NA	NA	NA	NA	NA

[a] PPE dermal unit exposure includes long pants, long shirts and gloves for scenarios 5, 7, and 9. PPE dermal unit exposure includes long pants, long shirts gloves and double layer (50% protection) for scenarios 1a, 1b, 1c, and 8.

[b] Daily Dermal Dose (mg/kg/day) = Daily Dermal Exposure (mg/day)/ Body weight (60 kg)* Dermal Absorption Factor (9%) .

[c] Short-term **or** Intermediate-term Dermal MOE = NOAEL (12 mg/kg/day)/ Daily Dermal Dose (mg/kg/day).

[d] PPE inhalation unit exposure represents dust/ mist respirator for scenarios 1a, 1b, 1c, and 8.

[e] Daily Inhalation Dose (mg/kg/day) = Daily Inhalation Exposure (mg/day)/ Body weight (60 kg).

[f] Short-term **or** Intermediate-term Inhalation MOE = NOAEL (12 mg/kg/day)/ Daily Inhalation Dose (mg/kg/day).

[g] Total Dermal MOE = 1/ ((1/ Dermal MOE) + (1/ Inhalation MOE)).

NA= Not applicable

Table A3: Occupational Handler Short-term and Intermediate-term Risk from Oxadiazon at Engineering Control

Exposure Scenario (Scenario #)	Crop type	PPE Dermal			PPE Inhalation			Total MOE[g]
		Unit Exposure (mg/lb ai)[a]	Daily Dose (mg/kg/day)[b]	Dermal MOE[c]	Unit Exposure (ug/lb ai)[d]	Daily Dose (mg/kg/day)[e]	Inhalation MOE[f]	
Mixer/Loader								
Mixing/Loading Wettable Powders for Chemigation Application (1a)	sod farms	0.0098 (water soluble Packages)	0.015	780	0.24	0.00420	2900	610
Mixing/Loading Wettable Powders for Groundboom Application (1b)	conifer nurseries, woody ornamentals		NA	NA		NA	NA	NA
	herbaceous ornamentals		NA	NA		NA	NA	NA
	sod farms		NA	NA		NA	NA	NA
	golf courses		NA	NA		NA	NA	NA
Mixing/Loading Wettable Powders for Rights-of-Way Sprayer (1c)	roadside turf, ornamentals		NA	NA		NA	NA	NA
Loading Granular formulations (2)	sod farms, conifers forest	NA	NA	NA	NA	NA	NA	NA
	golf course turf, parks, recreational areas		NA	NA		NA	NA	NA
	woody ornamentals		NA	NA		NA	NA	NA
Applicator								
Applying with a Groundboom (3)	sod farms	NA	NA	NA		NA	NA	NA
	herbaceous ornamentals		NA	NA		NA	NA	NA
	golf courses		NA	NA		NA	NA	NA
	conifer nurseries, woody ornamentals		NA	NA		NA	NA	NA
Applying with a Rights-of-Way Sprayer (4)	roadsides	NA	NA	NA	NA	NA	NA	NA
Applying Wettable-Powders for Handgun Applicators (ORETF) (5)	lawns, parks, recreational areas	NA	NA	NA	NA	NA	NA	NA
Applying Granular with a Tractor Drawn Spreader (6)	sod farms	NA	NA	NA	NA	NA	NA	NA

Table A3: Occupational Handler Short-term and Intermediate-term Risk from Oxadiazon at Engineering Control

Exposure Scenario (Scenario #)	Crop type	PPE Dermal			PPE Inhalation			Total MOE[g]
		Unit Exposure (mg/lb ai)[a]	Daily Dose (mg/kg/day)[b]	Dermal MOE[c]	Unit Exposure (ug/lb ai)[d]	Daily Dose (mg/kg/day)[e]	Inhalation MOE[f]	
	golf courses	NA	NA	NA	NA	NA	NA	NA
Mixer/Loader/Applicator								
Backpack Sprayer (LCO) (7)	lawns, golf courses, ornamentals nurseries	NA	NA	NA	NA	NA	NA	NA
Low Pressure Handwand - Wettable Powder Formulations (LCO) (8)	lawns, golf courses, nursery stock	NF	NF	NF	NF	NF	NF	NF
High Pressure Handwand -- (Wettable Powder Formulations) (9)	woody ornamentals, conifer nurseries.	NA	NA	NA	NA	NA	NA	NA
Lawn Handgun (Wettable Powder Formulations) (ORETF) (10)	ornamentals, lawns, parks rec areas	NA	NA	NA	NA	NA	NA	NA
Granulars with a Push Type Spreader (ORETF) (11)	lawns, golf courses, parks, recreational areas, ornamentals	NA	NA	NA	NA	NA	NA	NA
Granulars with a Bellygrinder (LCO) (12)	golf courses, parks, rec areas.	NA	NA	NA	NA	NA	NA	NA

[a] Engineering Control dermal unit exposure scenarios includes long pants, long shirts, gloves and water soluble packages for scenario 1a.
[b] Daily Dermal Dose (mg/kg/day) = Daily Dermal Exposure (mg/day)/ Body weight (60 kg)* Dermal Absorption Factor (9%) .
[c] Short-term **or** Intermediate-term Dermal MOE = NOAEL (12 mg/kg/day)/ Daily Dermal Dose (mg/kg/day).
[d] inhalation unit exposure represents no respirator
[e] Daily Inhalation Dose (mg/kg/day) = Daily Inhalation Exposure (mg/day)/ Body weight (60 kg).
[f] Short-term **or** Intermediate-term Inhalation MOE = NOAEL (12 mg/kg/day)/ Daily Inhalation Dose (mg/kg/day).
[g] Total Dermal MOE = 1/ ((1/ Dermal MOE) + (1/ Inhalation MOE)).

NA = Not applicable
NF = Not feasible

Table A4 : Exposure Scenario Descriptions for the Use of Oxadiazon

Exposure Scenario #	Data Source	Standard Assumptions[a] (8-hr work day)	Comments[b]
Mixer/Loader Descriptors			
Mixing/Loading Wettable Powder Formulations (1a/1b/1c)	PHED V1.1	350 acres for chemigation, 80 acres for groundboom in sod farms, 40 acres for groundboom on golf course turf, 5 acres/day for the turf loading scenarios	**Baseline:** Hands, dermal and inhalation = ABC grades. Hands = 7 replicates, dermal = 22-45 replicates and inhalation = 44 replicates. Low confidence in dermal, hands data due to the low number of hand replicates. Medium confidence in inhalation data. **PPE**: Gloved data for hands = ABC grades. Hands = 24 replicates. Medium confidence in hands data. Dermal values calculated by applying a 50% protection factor to baseline values to account for an additional layer of clothing. A 5-fold PF (e.g. 80% PF was applied to the baseline inhalation data). **Engineering Controls**: Water soluble bags. Dermal = AB grades. Hands and inhalation = All grade. Inhalation = 15 replicates, dermal = 6-15 replicates and hands = 5 replicates. Low confidence in the dermal, hands and inhalation data.
Loading Granular Formulations (2)	PHED V1.1	80 acres for tractor drawn spreaders for most crops; 40 acres for golf course turf	**Baseline:** Low confidence in dermal and hand data (due to low hand replicates). High confidence in inhalation data. No protection factors were needed to define the unit exposure values.
Applicator Descriptors			
Groundboom Application (3)	PHED V1.1	80 acres for tractor drawn spreaders for sod farms; 40 acres for golf course turf	**Baseline:** Dermal (23 to 42 replicates); hand (29 replicates); and inhalation (22 replicates) exposure values are based on AB grade data. High confidence in the unit exposure values. No protection factors were required to define the unit exposure value.
Applying Liquids with Rights-of-Way Sprayer (4)	PHED V1.1	40 acres	**Baseline:** Dermal (4 to 20 replicates) exposure value is based on ABC grade data. Hand (16 replicates) exposure value based on AB grade data and inhalation (16 replicates) exposure value is based on A grade data. Low confidence in the dermal unit exposure value and high confidence in the inhalation data. No protection factors were needed to define the unit exposure value. **PPE:** The same dermal and inhalation data are used as for the baseline coupled, if needed, with a 50% protection factor to account for an additional layer of clothing and an 80% protection factor to account for the use of a dust/mist respirator. Gloved-hand (4 replicates) exposure value is based on AB grade data. Low confidence in the dermal/hand unit exposure value. **Engineering Controls:** Not available for this scenario.
Applying Liquids with a Handgun (5) (ORTEF)	ORTEF	5 acres	**Baseline:** Inhalation (90 replicates) exposure value is based on B grade data. **PPE:** Hand (90 replicates) and dermal (90 replicates) exposure values are based on B grade data. **Engineering Controls:** Not available for this scenario
Applying Granulars with a Tractor Drawn Spreader (6)	PHED V1.1	40 acres for golf course turf	**Baseline:** Low confidence in hand, dermal, and inhalation data. No protection factors were required to define the unit exposure values.
Mixer/Loader/Applicator Descriptors			

Table A4 : Exposure Scenario Descriptions for the Use of Oxadiazon

Exposure Scenario #	Data Source	Standard Assumptions[a] (8-hr work day)	Comments[b]
Mixing/Loading/Applying with a Backpack Sprayer (7)	PHED V1.1	5 acres for occupational uses	**Baseline:** Only low confidence inhalation data available (no non-gloved hand monitoring data are available, therefore the assessment was not completed). **PPE:** Low confidence single layer clothing dermal monitoring data available, coupled with a 50% protection factor to account for an additional layer of clothing. Inhalation data coupled with a 90% protection factor to account for the use of a respirator. Hand exposure data with gloves were monitored (considered low confidence). **Engineering Controls:** Not feasible
Mixing/Loading/Applying Liquids with a Low Pressure Handwand (8)	PHED V1.1	5 acres for occupational uses	**Baseline**: Dermal and inhalation data = ABC grades, and hands data = All grade. Dermal = 9-80 replicates; hands = 70 replicates; and inhalation = 80 replicates. Low confidence in hands, dermal data. Medium confidence in inhalation data. **PPE and Engineering Controls**: Not required for assessment.
Mixing/Loading/Applying with a High Pressure Handwand (9)	PHED V1.1	5 acres	**Baseline:** Only low confidence inhalation data available (no non-gloved hand monitoring data are available, therefore the assessment was not completed). **PPE:** Low confidence single layer clothing dermal monitoring data available, coupled with a 50% protection factor to account for an additional layer of clothing. Inhalation data coupled with a 90% protection factor to account for the use of a respirator. Hand exposure data with gloves were monitored (considered low confidence). **Engineering Controls:** Not feasible
Mixing/Loading/Applying with a Handgun (turf grass application) (10)	ORTEF	5 acres for occupational uses.	Data for open mixing of liquids and handgun turfgrass application were combined to generate mixer/loader/applicator value as this is the most likely exposure scenario. **Baseline for application:** Low confidence in hand, dermal, and inhalation data. Baseline dataset was based on the use of chemical-resistant gloves. Therefore, a reverse 80% PF was used on the gloved hand data to assess baseline exposure for individuals wearing no gloves (i.e., it is a typical use scenario demanding a baseline assessment and the exposures are generally lower compared with other handheld methods). **PPE for applicator:** As appropriate, the same dermal, hand, and inhalation data are used as for the baseline coupled with a 50% protection factor to account for an additional layer of clothing and a 80% protection factor to account for the use of a respirator. Hand exposure data with gloves were monitored (considered low confidence). **Engineering Controls:** Not feasible.
Mixing/Loading/Applying with a Push-Type Granular Spreader (11)	ORTEF	5 acres for occupational uses.	**Baseline:** Low confidence in the dermal and hand data. High confidence in the inhalation data. No protection factors were required to define the unit exposure values (a 50 percent protection factor was used to back calculate the homeowner exposure scenario).
Mixing/Loading/Applying with a Bellygrinder (12)	PHED V1.1	5 acres for occupational uses.	**Baseline:** Medium confidence in hand and dermal data. High confidence in inhalation data. No protection factors were required to define the unit exposure values (also applies to homeowner scenarios).

[a] All *Standard Assumptions* are based on a typical work day (the components that involve pesticide use) as estimated by HED.

[b] All handler exposure assessments in this document are based on the "Best Available" data as defined by the PHED SOP for meeting Subdivision U Guidelines (i.e., completing exposure assessments). Best available grades are assigned to data as follows: matrices with A and B grade data (i.e., Acceptable Grade Data) and a minimum of 15 replicates; if not available, then grades

A, B and C data and a minimum of 15 replicates; if not available, then all data regardless of the quality (i.e., All Grade Data) and number of replicates. Generic data confidence categories are assigned as follows:

High = grades A and B and 15 or more replicates per body part
Medium = grades A, B, and C and 15 or more replicates per body part
Low = grades A, B, C, D and E or any combination of grades with less than 15 replicates.

Protection factors applied to exposure data for the use of respiratory protection, protection afforded with the use of an additional layer of clothing, and protection from the use of chemical resistant gloves are as follows: 90 % (respirator); 50 % (layer of clothing); and 90% (gloves).

APPENDIX B

OCCUPATIONAL HANDLER CANCER (Q^*) RISKS

TABLES B1 - B4

Table B1: Occupational Handler, Cancer (Q*) Risk from Oxadiazon at baseline

Exposure Scenario #	Crop Type	Total Baseline Daily Dose (mg/kg/day)[a]	Baseline Daily LADD[b] 3/30 days	Baseline Risk[c]
Mixer/Loader Exposure				
Mixing/Loading Wettable Powders for Chemigation Application (1a)	sod farms	5.600	2.30e-02/2.30e-01	1.65e-03/1.65-02
Mixing/Loading Wettable Powders for Groundboom Application (1b)	conifer nurseries, woody ornamentals	0.860	3.50e-03/3.5e-02	2.51e-04/2.51e-03
	herbaceous ornamentals	0.640	2.60e-03/2.60e-02	1.88e-04/1.88e-03
	sod farms	1.300	5.30e-03/5.30e-02	3.77e-04/3.77e-03
	golf courses	0.860	3.50e-03/3.50e-02	2.51e-04/2.51e-03
Mixing/Loading Wettable Powders for Rights-of-Way Sprayer (1c)	roadside turf, ornamentals	0.860	3.50e-03/3.50e-02	3.14e-05/3.14e-04
Loading Granular formulations (2)	sod farms, conifers forest	0.011	4.60e-04/4.60e-03	3.28e-06/3.28e-05
	golf course turf, parks, recreational areas	0.0056	2.30e-05/2.30e-04	1.64e-06/1.64e-05
	woody ornamentals	0.0056	2.30e-05/2.30e-04	1.64e-06/1.64e-05
Applicator				
Applying with a Groundboom (3)	sod farms	0.007	2.80e-05/2.80e-04	2.00e-06/2.00e-05
	herbaceous ornamentals	0.003	1.40e-05/1.40e-04	1.00e-06/1.00e-05
	golf courses	0.005	1.90e-05/1.90e-04	1.34e-06/1.34e-05
	conifer nurseries, woody ornamentals	0.005	1.90e-05/1.90e-04	1.34e-06/1.34e-05
Applying with a Rights-of-Way Sprayer (4)	roadsides	0.280	1.10e-03/1.10e-02	8.07e-05/8.07e-04
Applying Wettable-Powders for Handgun Applicators (ORETF) (5)	lawns, parks, recreational areas	See PPE	See PPE	See PPE/
Applying Granular with a Tractor Drawn Spreader (6)	sod farms	0.010	1.30e-05/1.30e-04	9.31e-07/9.31e-06
	golf courses	0.005	6.50e-06/6.50e-05	4.66e-07/4.66e-06
Mixer/Loader/Applicator				
Backpack Sprayer (LCO) (7)	lawns, golf courses, ornamentals nurseries	See PPE	See PPE	See PPE
Low Pressure Handwand - Wettable Powder Formulations (LCO) (8)	lawns, golf courses, nursery stock	1.060	4.40e-03/4.40e-02	3.10e-04/3.10e-03

Table B1: Occupational Handler, Cancer (Q*) Risk from Oxadiazon at baseline

Exposure Scenario #	Crop Type	Total Baseline Daily Dose (mg/kg/day)[a]	Baseline Daily LADD[b] 3/30 days	Baseline Risk[c]
High Pressure Handwand -- (Wettable Powder Formulations) (9)	woody ornamentals, conifer nurseries.	See PPE	See PPE	See PPE
Lawn Handgun (Wettable Powder Formulations) (ORETF) (10)	ornamentals, lawns, parks rec areas	0.036	1.50e-04/1.50e-03	1.06e-05/1.06e-04
Granulars with a Push Type Spreader (ORETF) (11)	lawns, golf courses, parks, recreational areas, ornamentals	0.008	3.30e-05/3.30e-04	2.33e-06/2.33e-05
Granulars with a Bellygrinder (LCO) (12)	golf courses, parks, rec areas.	0.055	2.30e-04/2.30e-03	1.61e-05/1.61e-04

[a] Baseline Total Daily Dose = [Baseline Daily Dermal Exposure (mg/day) * Dermal absorption factor (9%) + Baseline Daily Inhalation Exposure (mg/day)]/Body Weight (70 kg).

[b] Baseline LADD (mg/kg/day) = Baseline Total Daily Dose (mg/kg/day) * (Number of days exposed per year) /365 days per year) * 35 years worked/70 year lifetime.

[c] Baseline Total Cancer Risk = Baseline LADD (mg/kg/day) * (Q_1*), where Q_1* = $7.11e^{-2}$ $(mg/kg/day)^{-1}$.

Baseline cancer risk includes long pants, long shirts no gloves and no respirator.

Two exposure frequencies were used for cancer, the first represented the maximum number of applications per site per season to represent private use (3), and the second frequency applied a factor of ten to the first frequency to represent commercial handlers making multiple applications per site per season (30).

Table B2: Occupational Handler, Cancer (Q*) Risk from Oxadiazon at PPE

Exposure Scenario #	Crop Type	Total PPE 1 Daily Dose (mg/kg/day)[a]	PPE 1 LADD[b] 3/30 days	PPE 1 Risk[c]	Total PPE 2 Daily Dose (mg/kg/day)[a]	PPE 2 LADD[b] 3/30 days	PPE2 Risk[c]
Mixer/Loader Exposure							
Mixing/Loading Wettable Powders for Chemigation Application (1a)	sod farms	0.870	3.58e-03/ 3.58e-02	2.56e-04/ 2.56e-03	0.82	3.37e-01/ 3.37e-02	2.40e-04/ 2.40e-03
Mixing/Loading Wettable Powders for Groundboom Application (1b)	conifer nurseries, woody ornamentals	0.130	5.48e-04/ 5.48e-03	3.89e-05/ 3.89e-04	0.130	5.14e-4/ 5.14e-03	3.65e-05/ 3.65e-04
	herbaceous ornamentals	0.100	4.11e-04/ 4.11e-03	2.92e-05/ 2.92e-04	0.094	3.85e-04/ 3.85e-03	2.74e-05/ 2.74e-04
	sod farms	0.200	8.22e-04/ 8.22e-03	5.84e-05/ 5.84e-04	0.190	7.71e-04/ 7.71e-03	5.48e-05/ 5.48e-04
	golf courses	0.130	5.48e-04/ 5.48e-03	3.89e-05/ 3.89e-04	0.130	5.14e-04/ 5.14e-04	3.65e-05/ 3.65e-04
Mixing/Loading Wettable Powders for Rights-of-Way Sprayer (1c)	roadside turf, ornamentals	0.130	5.48e-04/ 5.48e-03	3.89e-05/ 3.89e-04	0.016	5.14e-04/ 5.14e-03	4.57e-06/ 4.57e-04
Loading Granular formulations (2)	sod farms, conifers forest	0.011	4.36e-05/ 4.36e-04	3.10e-06/ 3.10e-05	0.009	3.77e-05/ 3.77e-04	2.68e-06/ 2.68e-05
	golf course turf, parks, recreational areas	0.005	2.18e-05/ 2.18e-04	1.55e-06/ 1.55e-05	0.0046	1.88e-05/ 1.88e-04	1.34e-06/ 1.34e-05
	woody ornamentals	0.005	2.18e-05/ 2.18e-04	1.55e-06/ 1.55e-05	0.0046	1.88e-05/ 1.88e-04	1.34e-06/ 1.34e-05
Applicator							
Applying with a Groundboom (3)	sod farms	0.007	2.82e-05/ 2.82e-04	2.00E-06/ 2.00e-05	0.0059	2.44e-05/ 2.44e-04	1.73e-06/ 1.73e-05
	herbaceous ornamentals	0.003	1.41e-05/ 1.41e-04	1.00e-06/ 1.00e-05	0.003	1.22e-05/ 1.22e-04	8.67e-07/ 8.67e-06
	golf courses	0.005	1.88e-05/ 1.88e-04	1.34e-06/ 1.34e-05	0.004	1.63e-05/ 1.63e-04	1.16e-06/ 1.16e-05
	conifer nurseries, woody ornamentals	0.005	1.88e-05/ 1.88e-04	1.34e-06/ 1.34e-05	0.004	1.63e-05/ 1.63e-04	1.16e-06/ 1.16e-05

Table B2: Occupational Handler, Cancer (Q*) Risk from Oxadiazon at PPE

Exposure Scenario #	Crop Type	Total PPE 1 Daily Dose (mg/kg/day)[a]	PPE 1 LADD[b] 3/30 days	PPE 1 Risk[c]	Total PPE 2 Daily Dose (mg/kg/day)[a]	PPE 2 LADD[b] 3/30 days	PPE2 Risk[c]
Applying with a Rights-of-Way Sprayer (4)	roadsides	0.890	3.66e-04/ 3.66e-03	2.60e-05/ 2.60e-04	0.069	2.82e-04/ 2.82e-03	2.00e-05/ 2.00e-04
Applying Wettable-Powders for Handgun Applicators (ORETF) (5)	lawns, parks, recreational areas	0.019	7.83e-05/ 7.83e-04	5.57e-06/ 5.57e-05	0.010	4.13e-05/ 4.13e-04	2.94e-06/ 2.94e-05
Applying Granular with a Tractor Drawn Spreader (6)	sod farms	0.008	1.16e-05/ 1.16e-04	8.23e-07/ 8.23e-05	0.0072	9.88e-06/ 9.88e-05	7.03e-07/ 7.03e-06
	golf courses	0.004	5.79e-06/ 5.79e-05	4.11e-07/ 4.11e-06	0.0036	4.94e-06/ 4.94e-05	3.51e-07/ 3.51e-06
Mixer/Loader/Applicator							
Backpack Sprayer (LCO) (7)	lawns, golf courses, ornamentals nurseries	0.073	2.99e-04/ 2.99e-03	2.13e-05/ 2.13e-04	0.05	2.04e-04/ 2.04e-03	1.45e-05/ 1.45e-04
Low Pressure Handwand - Wettable Powder Formulations (LCO) (8)	lawns, golf courses, nursery stock	0.540	2.20e-03/ 2.20e-03	1.56e-04/ 1.56e-03	0.47	1.95e-03/ 1.95e-02	1.38e-04/ 1.38e-03
High Pressure Handwand -- (Wettable Powder Formulations) (9)	woody ornamentals, conifer nurseries.	0.064	2.64e-04/ 2.64e-03	1.88e-05/ 1.88e-04	0.041	1.69e-04/ 1.69e-03	1.20e-05/ 1.20e-04
Lawn Handgun (Wettable Powder Formulations) (ORETF) (10)	ornamentals, lawns, parks rec areas	0.036	1.49e-04/ 1.49e-03	1.06e-05/ 1.06e-04	0.027	1.13e-04/ 1.13e-03	8.03e-06/ 8.03e-05
Granulars with a Push Type Spreader (ORETF) (11)	lawns, golf courses, parks, recreational areas, ornamentals	0.006	2.54e-05/ 2.54e-04	1.80e-06/ 1.80e-05	No Data	No Data	No data
Granulars with a Bellygrinder (LCO) (12)	golfcourses, parks, rec areas.	0.051	2.11e-04/ 2.11e-03	1.50e-05/ 1.50e-04	0.033	1.35e-04/ 1.35e-03	9.60e-06/ 9.60e-05

[a] PPE1, 2 Total Daily Dose = [PPE Daily Dermal Exposure (mg/day) * Dermal absorption Factor (9%) + baseline Daily Inhalation Exposure (mg/day)]/Body Weight (70 kg).

[b] PPE1, 2 LADD (mg/kg/day) = PPE Total Daily Dose (mg/kg/day) * (Number of days exposed per year) /365 days per year) * 35 years worked/70 year lifetime.

[C] PPE1, 2 Total Cancer Risk = PPE LADD (mg/kg/day) * (Q_1*), where Q_1* = $7.11e^{-2}$ $(mg/kg/day)^{-1}$.

PPE 1 cancer risk includes long pants, long shirts, gloves and no respirator.

PPE 2 cancer risk includes long pants, long shirts, double layer, gloves and no respirator.

Two exposure frequencies were used for cancer, the first represented the maximum number of applications per site per season to represent private use (3), and the second frequency applied a factor of ten to the first frequency to represent commercial handlers making multiple applications per site per season (30).

Table B3: Occupational Handler, Cancer (Q*) Risk from Oxadiazon at PPE

Exposure Scenario #	Crop Type	Total PPE 3 Daily Dose (mg/kg/day)[a]	PPE 3 LADD[b] 3/30 days	PPE 3 Risk[c]	Total PPE 4 Daily Dose (mg/kg/day)[a]	PPE 4 LADD[b] 3/30 days	PPE 4 Risk[c]
Mixer/Loader Exposure							
Mixing/Loading Wettable Powders for Chemigation Application (1a)	sod farms	0.360	1.47e-03/ 1.47e-02	1.05E-04/ 1.05e-03	0.3	1.25e-03/ 1.25e-02	8.90e-05/ 8.90e-04
Mixing/Loading Wettable Powders for Groundboom Application (1b)	conifer nurseries, woody ornamentals	0.055	2.25e-04/ 2.25e-03	1.60e-05/ 1.60e-04	0.046	1.91e-04/ 1.91e-03	1.36e-05/ 1.36e-04
	herbaceous ornamentals	0.041	1.68e-04/ 1.68e-03	1.20e-05/ 1.20e-04	0.035	1.43e-04/ 1.43e-03	1.02e-05/ 1.02e-04
	sod farms	0.082	3.37e-04/ 3.37e-03	2.39e-05/ 2.39e-04	0.070	2.86e-04/ 2.86e-03	2.03e-05/ 2.03e-04
	golf courses	0.055	2.25e-04/ 2.25e-03	1.60e-05/ 1.60e-04	0.046	1.91e-04/ 1.91e-03	1.36e-05/ 1.36e-04
Mixing/Loading Wettable Powders for Rights-of-Way Sprayer (1c)	roadside turf, ornamentals	0.055	2.25e-04/ 2.25e-03	1.60e-05/ 1.60e-04	0.046	1.91e-04/ 1.91e-03	1.36e-05/ 1.36e-04
Loading Granular formulations (2)	sod farms, conifers forest	0.004	1.81e-05/ 1.81e-04	1.28e-06/ 1.28e-05	0.003	1.21e-05/ 1.21e-04	8.63e-07/ 8.63e-06
	golf course turf, parks, recreational areas	0.002	9.03e-06/ 9.03e-05	6.42e-07/ 6.42e-06	0.0015	6.07e-06/ 6.07e-05	4.31e-07/ 4.31e-06
	woody ornamentals	0.002	9.03e-06/ 9.03e-07	6.42e-07/ 6.42e-06	0.0015	6.07e-06/ 6.07e-05	4.31e-07/ 4.31e-06
Applicator							
Applying with a Groundboom (3)	sod farms	0.005	1.99e-05/ 1.99e-04	1.41e-06/ 1.41e-05	0.0039	1.61e-05/ 1.61e-04	1.14e-06/ 1.14e-05
	herbaceous ornamentals	0.002	9.93e-06/ 9.93e-05	7.06e-07/ 7.06e-06	0.002	8.03e-06/ 8.03e-05	5.71e-07/ 5.71e-06
	golf courses	0.003	1.32e-05/ 1.32e-04	9.42e-07/ 9.42e-06	0.003	1.07e-05/ 1.07e-04	7.61e07/ 7.61e-06

Table B3: Occupational Handler, Cancer (Q*) Risk from Oxadiazon at PPE

Exposure Scenario #	Crop Type	Total PPE 3 Daily Dose (mg/kg/day)[a]	PPE 3 LADD[b] 3/30 days	PPE 3 Risk[c]	Total PPE 4 Daily Dose (mg/kg/day)[a]	PPE 4 LADD[b] 3/30 days	PPE 4 Risk[c]
	conifer nurseries, woody ornamentals	0.003	1.32e-05/ 1.32e-04	9.42e07/ 9.42e-06	0.003	1.07e-05/ 1.07e-04	7.61e07/ 7.61e-06
Applying with a Rights-of-Way Sprayer (4)	roadsides	0.082	3.37e-04/ 3.37e-03	2.40e-05/ 2.40e-04	0.061	2.52e-04/ 2.52e-03	1.80e-05/ 1.80e-04
Applying Wettable-Powders for Handgun Applicators (ORETF) (5)	lawns, parks, recreational areas	0.019	7.74e-05/ 7.74e-04	5.50e06/ 5.50e-05	0.0098	4.04e-05/ 4.04e-04	2.87e06/ 2.87e-05
Applying Granular with a Tractor Drawn Spreader (6)	sod farms	0.004	5.56e-06/ 5.56e-05	3.95e07/ 3.95e-06	0.0028	3.87e-06/ 3.87e-05	2.75e07/ 2.75e-06
	golf courses	0.002	2.78e-06/ 2.78e-05	1.98e07/ 1.98e-06	0.0014	1.94e-06/ 1.94e-05	1.38e07/ 1.38e-06
Mixer/Loader/Applicator							
Backpack Sprayer (LCO) (7)	lawns, golf courses, ornamentals nurseries	0.066	2.71e-04/ 2.71e-03	1.93e-05/ 1.93e-04	0.043	1.76e-04/ 1.76e-03	1.25e05/ 1.25e-04
Low Pressure Handwand - Wettable Powder Formulations (LCO) (8)	lawns, golf courses, nursery stock	0.280	1.17e-03/ 1.17e-02	8.30e05/ 8.30e-04	0.22	9.14e-04/ 9.14e-03	6.50e05/ 6.50e-04
High Pressure Handwand -- (Wettable Powder Formulations) (9)	woody ornamentals, conifer nurseries.	0.068	2.79e-04/ 2.79e-03	1.98e05/ 1.98e-04	0.045	1.84e-04/ 1.84e-03	1.31e05/ 1.31e-04
Lawn Handgun (Wettable Powder Formulations) (ORETF) (10)	ornamentals, lawns, parks rec areas	0.022	9.06e-05/ 9.06e-04	6.44e-06/ 6.44e-05	0.013	5.47e-05/ 5.47e-04	3.89e06/ 3.89e-05
Granulars with a Push Type Spreader (ORETF) (11)	lawns, golf courses, parks, recreational areas, ornamentals	0.006	2.54e-05/ 2.54e-04	1.80e06/ 1.80e-05	No Data	No Data	No data
Granulars with a Bellygrinder (LCO) (12)	golfcourses, parks, rec areas.	0.049	1.99e-04/ 1.99e-03	1.42e05/ 1.42e-04	0.03	1.23e-04/ 1.23e-03	8.77e06/ 8.77e-05

[a] PPE 3,4 Total Daily Dose = [PPE Daily Dermal Exposure (mg/day) * Dermal absorption Factor (9%)+baseline Daily Inhalation Exposure (mg/day)]/Body Weight (70 kg).

[b] PPE 3, 4 LADD (mg/kg/day) = PPE Total Daily Dose (mg/kg/day) * (Number of days exposed per year) /365 days per year) * 35 years worked/70 year lifetime.

[C] PPE 3, 4 Total Cancer Risk = PPE LADD (mg/kg/day) * (Q_1*), where Q_1* = $7.11e^{-2}$ $(mg/kg/day)^{-1}$.

PPE3 cancer risk includes long pants, long shirts, gloves and respirator.

PPE 4 cancer risk includes long pants, long shirts, double layer, gloves and respirator

Two exposure frequencies were used for cancer, the first represented the maximum number of applications per site per season to represent private use (3), and the second frequency applied a factor of ten to the first frequency to represent commercial handlers making multiple applications per site per season (30).

Table B4: Occupational Handler, Cancer (Q*) Risk from Oxadiazon at Eengineering Control

Exposure Scenario #	Crop Type	Total Eng.Control Daily Dose (mg/kg/day)[a]	Eng.Control LADD[b] 3/30 days	Eng Control Risk[c]
Mixer/Loader Exposure				
Mixing/Loading Wettable Powders for Chemigation Application (1a)	sod farms	0.0170	6.92e-05/6.92e-04	4.92E-06/4.92e-05
Mixing/Loading Wettable Powders for Groundboom Application (1b)	conifer nurseries, woody ornamentals	0.0026	1.05e-05/1.05e-04	7.49E-07/7.49e-06
	herbaceous ornamentals	0.0019	7.90e-06/7.90e-05	5.62E-07/5.62e-06
	sod farms	0.0038	1.58e-05/1.58e-04	1.12E-06/1.12e-05
	golf courses	0.0026	1.05e-05/1.05e-04	7.49E-07/7.49e-06
Mixing/Loading Wettable Powders for Rights-of-Way Sprayer (1c)	roadside turf, ornamentals	0.0026	1.05e-05/1.05e-04	7.49E-07/7.49e-06
Loading Granular formulations (2)	sod farms, conifers forest	0.0002	3.09e-073.09e-06	2.20E-08/2.20e-07
	golf course turf, parks, recreational areas	0.0001	1.54e-07/1.54e-06	1.10E-08/1.10e-07
	woody ornamentals	0.0001	4.63e-07/4.63e-06	3.29E-08/3.29e-07
Applicator				
Applying with a Groundboom (3)	sod farms	0.0017	6.95e-06/6.95e-05	4.94E-07/4.94e-06
	herbaceous ornamentals	0.0009	3.47e-06/3.47e-05	2.47E-07/2.47e-06
	golf courses	0.0011	4.63e-06/4.63e-05	3.29E-07/3.29e-06
	conifer nurseries, woody ornamentals	0.0011	4.63e-06/4.63e-05	3.29E-07/3.29e-06
Applying with a Rights-of-Way Sprayer (4)	roadsides	NF	NF	NF
Applying Wettable-Powders for Handgun Applicators (ORETF) (5)	lawns, parks, recreational areas	NF	NF	NF
Applying Granular with a Tractor Drawn Spreader (6)	sod farms	0.0019	2.56e-06/2.56e-05	1.82E-07/1.82e-06
	golf courses	0.0009	1.28e-06/1.28e-05	9.11E-08/9.11e-07
Mixer/Loader/Applicator				
Backpack Sprayer (LCO) (7)	lawns, golf courses, ornamentals nurseries	NF	NF	NF
Low Pressure Handwand - Wettable Powder Formulations (LCO) (8)	lawns, golf courses, nursery stock	NF	NF	NF

Table B4: Occupational Handler, Cancer (Q*) Risk from Oxadiazon at Eengineering Control

Exposure Scenario #	Crop Type	Total Eng.Control Daily Dose (mg/kg/day)[a]	Eng.Control LADD[b] 3/30 days	Eng Control Risk[c]
High Pressure Handwand -- (Wettable Powder Formulations) (9)	woody ornamentals, conifer nurseries.	NF	NF	NF
Lawn Handgun (Wettable Powder Formulations) (ORETF) (10)	ornamentals, lawns, parks rec areas	NF	NF	NF
Granulars with a Push Type Spreader (ORETF) (11)	lawns, golf courses, parks, recreational areas, ornamentals	NF	NF	NF
Granulars with a Bellygrinder (LCO) (12)	golfcourses, parks, rec areas.	NF	NF	NF

[a] Eng. Control Total Daily Dose =[Eng. Control Daily Dermal Exposure (mg/day)*Dermal Absorption Factor (9%)+baseline Daily Inhalation Exposure (mg/day)]/Body Weight (70 kg).

[b] Eng. Control LADD (mg/kg/day) = Eng. control Total Daily Dose (mg/kg/day) * (Number of days exposed per year) /365 days per year) * 35 years worked/70 year lifetime.

[c] Eng. Control Total Cancer Risk = Eng. Control LADD (mg/kg/day) * (Q_1*), Q_1* = $7.11e^{-2}$ $(mg/kg/day)^{-1}$.

NF= Not feasible

Two exposure frequencies were used for cancer, the first represented the maximum number of applications per site per season to represent private use (3), and the second frequency applied a factor of ten to the first frequency to represent commercial handlers making multiple applications per site per season (30).

APPENDIX C

OCCUPATIONAL AND RESIDENTIAL POST APPLICATION

TABLES C1 - C4

Table C1: Occupational Short- and Intermediate-Term Postapplication Risks for Oxadiazon							
Crop/Use Pattern	Application Rate (lb ai/acre)	Postapplication Activity	Transfer Coefficient[a]	Short Term and Intermediate Term Risks		Cancer Risk	
				TTR[b] (ug/cm^2)	MOE[c]	LADD[d] mg/kg/day	Risk[e]
Golf Course Turf	4	Mow, seed, mechanical weed, aerate, fertilize, prune	500	2.0 (5% of application rate)	1,000	4.23e-5	3.01e-6
		Transplant, hand weed	16,500		30	1.39e-3	9.92e-5
Sod Farms		Mow, scout, mechanical weed, irrigate	500		1,000	4.23e-5	3.01e-6
		Transplant, hand weed, harvest (hand or mechanical)	16,500		30	1.39e-3	9.92e-5
Bermuda Grass Rights of Way		Mow, seed, scout, mechanical weed, aerate, fertilize	500		1,000	4.23e-5	3.01e-6

[a] Transfer coefficient from Science Advisory Council for Exposure: Policy Memo # 003 .1 "Agricultural Transfer Coefficients," Revised - August 7, 2000.

[b] TTR source: 5% of application rate, "Residential SOP Revised February 2001 " was used for determination of MOE's.

[c] MOE = Short-term NOAEL (12 mg/kg/day; based on an oral study) / dermal dose where absorbed dose = TTR ($\mu g/cm^2$) x TC (cm^2/hr) x conversion factor (1 mg/1,000 μg) x exposure time (8hrs/day)x dermal absorption (9 %) / body weight (60 kg; adult).

[d] absorbed dermal dose where absorbed dose = TTR ($\mu g/cm^2$) x TC (cm^2/hr) x conversion factor (1 mg/1,000 μg) x exposure time (8 hrs/day) x dermal absorption (9 %) / body weight (70 kg) x (Number of days (3) exposure per year applicator) /365 days per year) x 35 years worked/70 year lifetime

[e] Cancer Risk = LADD (mg/kg/day) x (Q_1*), where $Q_1^* = 7.11e^{-2}$ $(mg/kg/day)^{-1}$.

Note: TTR - Turf Transferable Residue rounded to 2.0 ug/cm^2

Table C2. Residential Dermal Postapplication Non-Cancer Risks for Oxadiazon			
Dermal Scenarios	Application Rate (lb ai/acre)	Exposure Time (hours/day)	Short Term and Intermediate Term Risks

			Transfer Coefficient (cm^2/hr)[a]	Transfer Coefficient (cm^2/hr) Irrigated[b]	Transfer Coefficient (cm^2/hr) Non-Irrigated[c]	TTR[d] (ug/cm^2) DAT 0-1	Dermal Dose (mg/kg/day)[e]	Dermal Dose (mg/kg/day) Irrigated[f]	Dermal Dose (mg/kg/day) Non-Irrigated[g]	MOEs[h]	MOEs [i] Irrigated	MOEs[j] Non-Irrigated
Adult dermal turf contact	4	2	14500	4300	7,400	1.53	NA	1.97e-2	3.40e-2	NA	610	350
						2.0	8.70e-2	NA	NA	140	NA	NA
Toddler dermal turf contact		2	5200	1600	2,700	0.87	NA	1.67e-2	2.82e-2	NA	720	430
						2.0	3.12e-2	NA	NA	390	NA	NA
Adult walking, playing golf		4	500	NA	NA	2.0	6.0e-3	NA	NA	2,000	NA	NA
Adult push mowing lawn		2	500	NA	NA	2.0	3.0e-3	NA	NA	4,000	NA	NA

a Transfer coefficient from the Residential SOP's (2/01) used for fresh grass
b Transfer coefficient from turf study MRID # 435178-01used for dormant grass
c Transfer coefficient from turf study MRID # 435178-01used for dormant grass
d TTR source: wettable powder from turf studies MRID # 435178-01, DAT 0-1 residue **or** residential SOP (5% application rate)
e Dermal dose (mg/kg/day) = TTR (5% application rate) ($\mu g/cm^2$) x TC (from residential SOP,s) (cm^2/hr) x conversion factor (1 mg/1,000 μg) x exposure time (2 or 4hrs/day) x dermal absorption (9 %) / body weight (60 kg adult or 15 kg toddler).
f Dermal dose (mg/kg/day) irrigated = TTR (from MRID #435178-01) ($\mu g/cm^2$) x TC (MRID #435178-01) (cm^2/hr) x conversion factor (1 mg/1,000 μg) x exposure time (2 hrs/day) x dermal absorption (9 %) / body weight (60 kg adult or 15 kg toddler).
g Dermal dose (mg/kg/day) non-irrigated = TTR (from MRID #435178-01) ($\mu g/cm^2$) x TC (MRID #435178-01) (cm^2/hr) x conversion factor (1 mg/1,000 μg) x exposure time (2 hrs/day) x dermal absorption (9 %) / body weight (60 kg adult or 15 kg toddler).
h MOE = Short-term NOAEL (12 mg/kg/day; based on an oral study) / dermal dose (mg/kg/day)
i MOE (irrigated) = Short-term NOAEL (12 mg/kg/day; based on an oral study) / dermal dose (mg/kg/day)
j MOE (non-irrigated) = Short-term NOAEL (12 mg/kg/day; based on an oral study) / dermal dose (mg/kg/day)

Note: TTR - Turf Transferable Residue rounded to 2.0 ug/cm^2

Table C3. Residential Dermal Postapplication Cancer Risks for Oxadiazon

Dermal Scenarios	Application Rate (lb ai/acre)	Exposure Time (hours/day)	Transfer Coefficient (cm^2/hr)[a]	Transfer Coefficient (cm^2/hr) Irrigated[b]	Transfer Coefficient (cm^2/hr) Non-Irrigated[c]	TTR[d] (ug/cm^2) DAT 0-1	LADD[e] mg/kg/day	LADD[f] mg/kg/day irrigated	LADD[g] mg/kg/day[f] Non-Irrigated	Cancer[h]	Cancer Irrigated[j]	Cancer[j] Non-irrigated
Adult dermal turf contact	4	2	14500	4300	7400	1.53	NA	6.95e-5	1.2e-4	NA	3.62e-6	6.22e-6

						2.0	3.06e-04	NA	NA	1.59e-5	NA	NA
Toddler dermal turf contact		2	5200	1600	2700	0.87	NF	NF	NF	NF	NF	NF
						2.0	NF	NF	NF	NF	NF	NF
Adult walking, playing golf		4	500	NA	NA	2.0	2.11e-5	NA	NA	1.50e-6	NA	NA
Adult push mowing lawn		2	500	NA	NA	2.0	1.06e-5	NA	NA	7.51e-7	NA	NA

a Transfer coefficient from the Residential SOP's (2/01) used for fresh grass

b Transfer coefficient from turf study MRID # 435178-01used for dormant grass

c Transfer coefficient from turf study MRID # 435178-01used for dormant grass

d TTR source: wettable powder and granular turf studies MRID # 435178-01, DAT 0-1 residue

e LADD (mg/kg/day) = TTR (μg/cm^2)(5% of application rate) x TC(residential SOP) (cm^2/hr) x conversion factor (1 mg/1,000 μg) x exposure time (2 or 4 hrs/day) x dermal absorption (9 %) / body weight (70 kg) x (Number of days (3) exposure per year applicator) /365 days per year) x 35 years worked/70 year lifetime

f LADD (mg/kg/day)(irrigated) = TTR (μg/cm^2) (from MRID # 435178-01) x TC (cm^2/hr)(from MRID # 435178-01) x conversion factor (1 mg/1,000 μg) x exposure time (2 hrs/day) x dermal absorption (9 %) / body weight (70 kg) x (Number of days (3) exposure per year applicator) /365 days per year) x 35 years worked/70 year lifetime

g LADD (mg/kg/day)(non-irrigated) = TTR (μg/cm^2)(from MRID # 435178-01) x TC(from MRID #435178-01) (cm^2/hr) x conversion factor (1 mg/1,000 μg) x exposure time (2 hrs/day) x dermal absorption (9 %) / body weight (70 kg) x (Number of days (3) exposure per year applicator) /365 days per year) x 35 years worked/70 year lifetime

h Cancer Risk = LADD (mg/kg/day) x (Q_1*), where Q_1* = 7.11e^{-2} (mg/kg/day)$^{-1}$.

i Cancer Risk (irrigated) = LADD (mg/kg/day) (irrigated) x (Q_1*), where Q_1* = 7.11e^{-2} (mg/kg/day)$^{-1}$.

j Cancer Risk (non-irrigated) = LADD (mg/kg/day)(non-irrigated) x (Q_1*), where Q_1* = 7.11e^{-2} (mg/kg/day)$^{-1}$.

NA= Not applicable
NF= Not Feasible

Note: TTR - Turf Transferable Residue rounded to 2.0 ug/cm^2

Table C4 Residential Oral Nondietary Postapplication Risks to Toddlers from "Hand-to-Mouth" and Ingestion Exposure When Reentering Lawns Treated with Granular or wettable powder Oxadiazon Formulations

Type of Exposure	Application Rate[a] (lb ai/acre)	Ingestion Rate or Other Assumptions[b]	Short-Term		
			TTR[c] (μg/cm^2) DAT 0-1	Oral Dose[d] (mg/kg/day)	MOE[e]
Hand to Mouth Activity	4	20 cm^2/event surface area of 1-3 fingers; 20 events/hr; fresh grass 5% of ai dislodgeable with potentially wet hands	2.0	1.19e-01	100
		20 cm^2/event surface area of 1-3 fingers; 20 events/hr; 2.1% of ai dislodgeable with potentially wet hands (dormant grass, irrigated)	1.0	5.02e-02	240
		20 cm^2/event surface area of 1-3 fingers; 20 events/hr; 5.5% of ai dislodgeable with potentially wet hands (dormant grass, non- irrigated)	2.5	1.31e-01	90
Incidental Turfgrass Ingestion		25 cm^2/day of turf 20% application rate (residential SOP) fresh grass	9.0	1.49e-02	805
		25 cm^2/day of turf Irrigated (MRID # 435178-01) used for dormant grass	0.87	2.60e-03	4700
		25 cm^2/day of turf Non-Irrigated(MRID # 435178-01)used for dormant grass	1.53	1.45e-03	8300
Incidental Ingestion of Soil		100 mg/day ingestion; 0.67 cm^3/gm soil	NA	2.12e-04	57000

a Application rates represent maximum label rates from current EPA registered labels.

b Assumptions from Residential SOP's (February, 2001). fresh grass

c TTR source: wettable powder and granular oxadiazon turf studies MRID Nos. 43517801. Short-term risks assessed using DAT 0-1 residue values.

d Oral doses calculated using formulas presented in the Residential SOPs (February, 2001). Short-term and intermediate-term doses were calculated using the following formulas. Intermediate term doses were each multiplied by the estimated fraction of oxadiazon residue remaining on DAT 7 after application.

Hand-to-mouth oral dose to toddlers on the day of treatment (mg/kg/day**)** = [application rate (lb ai/acre) x fraction of residue dislodgeable from potentially wet hands (see assumptions) x 11.2 (conversion factor to convert lb ai/acre to μg/cm^2)] x median surface area for 1-3 fingers (20 cm^2/event) x hand-to-mouth rate (ST: 20 events/hour) x exp. time (2 hr/day) x 0.001 mg/µg] / bw (15 kg toddler).

Grass ingestion oral dose to toddlers on the day of treatment (mg/kg/day) = [TTR (μg/cm^2) x ingestion rate of grass (25 cm^2/day) x 0.001 mg/µg] / bw (15 kg toddler).

Soil ingestion oral dose to toddlers on the day of treatment (mg/kg/day) = [(application rate (lb ai/acre) x fraction of residue retained on uppermost 1 cm of soil (100% or 1.0/cm) x 4.54E+08 μg/lb conversion factor x 2.47E-08 acre/cm^2 conversion factor x 0.67 cm^3/g soil conversion factor) x 100 mg/day ingestion rate x 1.0E-06 g/μg conversion factor] / bw (15 kg; toddler). Short term dose based residue on the soil on day of application.

NA= Not applicable

Note: TTR - Turf Transferable Residue

References

1) Revised Report of Hazard Identification Assessment Review Committee, Dec 21, 2001.

2) Oxadizon Labels.

2) Memorandum from J Blondell to S. Tadayon, 13 March, 2001

4) Pesticide Handler Exposure Database Version 1.1 Surrogate Exposure Table (newly organized) and printed August 1998.

S.Tadayon:810J:CM#2: (703) 305-5238